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THE LATEST FELINE VACCINATION PROTOCOLS

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It is always preferred to prevent rather than treat infections. Avoiding exposure is the most effective way to prevent infections. Most infectious agents of cats or dogs are transmitted in fecal material, respiratory secretions, reproductive tract secretions, urine; by bites or scratches; or by contact with vectors or reservoirs. Many infectious agents are environmentally resistant and can be transmitted by contact with a contaminated environment. Recognition of risk factors associated with infectious agents is the initial step to prevention of infectious diseases. Veterinarians should strive to understand the biology of each infectious agent so that they can counsel clients and staff on the best strategies for prevention. Vaccines available for some infectious agents can prevent infection or lessen clinical illness when infection occurs. However, vaccines are not uniformly effective and are not available for all pathogens; thus, it is paramount to develop sound biosecurity procedures to avoid exposure to infectious agents when developing a preventative medicine program.

The American Association of Feline Practitioners (AAFP), the Council on Biological and Therapeutic Agents, and the American Animal Hospital Association (AAHA) have published information concerning vaccination guidelines in the last several years (1-4). The AAFP and AAHA guidelines are endorsed by the American College of Veterinary Internal Medicine (ACVIM). The Colorado Veterinary Medical Association has “customized” vaccine guidelines to reflect the regional differences in infectious disease prevalence in our area. Other state veterinary medical associations might consider this as well. There are many vaccine antigens available for administration to cats or dogs. For some of the antigens, there is strong consensus nationally that all cats should be immunized (“core” vaccines). For other vaccine antigens, there are differences in regional prevalence of the disease in question or other reasons that make some antigens optional for some pets. All kittens, puppies, adult cats, and adult dogs with unknown vaccination history are optimally immunized with core vaccine antigens. Optional antigens and administration intervals should be individualized to each patient upon consultation with the owner and a discussion of benefits, risks, and costs. After the kitten or puppy vaccine series, each pet should be presented to the veterinary clinic for a general health examination and a vaccine needs risk assessment at least yearly. The following is a brief discussion of the feline and canine vaccine antigens currently available and new developments concerning use of each antigen.

VACCINATION PROTOCOLS FOR CATS

All healthy kittens and adult cats without a known vaccination history should be routinely vaccinated SQ or IM for panleukopenia, rhinotracheitis, and calicivirus (FVRCP); intranasal products can also be used. While the currently available intranasal product can cause mild clinical signs of disease in some cats, these are generally self-limited. Recently, several parenterally administered FVRCP vaccines but not an intranasal FVRCP vaccine were shown to induce antibodies that recognize renal tissues of cats (5). However, disease causation has not been determined to date. Most vaccine-associated soft tissue sarcomas have been associated with adjuvanted feline leukemia virus and rabies virus vaccines. However, tumors at injection sites have also been documented after both killed and modified live FVRCP vaccines (6).

Modified-live products should not be administered to clinically ill, debilitated, or pregnant animals, but are preferred over killed products in healthy cats, since cell-mediated immune responses are superior. Kittens presented at 6 to 12 weeks of age should receive a modified live or killed FVRCR with boosters given every 3-4 weeks until 12 weeks of age. Kittens presented at > 12 weeks of age and adult cats with unknown vaccination history should receive 2 killed or 2 modified live FVRCP 3-4 weeks apart. Parenteral products should be given SQ, low on the right forelimb so vaccine reactions can be tracked.

All cats should be vaccinated against rabies. Rabies vaccine should be administered SQ in the lower right rear limb at 12 or 16 weeks of age depending on local ordinances. Use of IM injection does not lessen the risk of vaccine sarcoma development but may make it harder to feel the mass as it develops.

At one year of age or one year after the last vaccination, booster FVRCP and rabies virus vaccines should be administered. After one year of age, risk of infection by herpesvirus 1, calicivirus, and panleukopenia should be assessed yearly. Based on serological and challenge studies, following the AAFP arbitrary guideline administering FVRCP vaccines every third year seems prudent (7,8). County rabies vaccination guidelines should be followed.

Serology can be used in lieu of arbitrary vaccination with FVRCP. In a study of 72 vaccinated and control cats that assessed 2 different parenteral vaccines, the positive predictive value of antibody titers against panleukopenia, calicivirus, and herpesvirus 1 were all 100% in appropriately vaccinated cats. Results were similar using virus neutralization (New York State Veterinary Diagnostic Laboratory, Ithaca, NY) or ELISA (Heska Corporation, Fort Collins, CO). In that study, 70.7%, 92.4%, and 68.5% of randomly screened, client-owned cats had titers predictive of protection against herpesvirus 1, calicivirus, and panleukopenia virus, respectively. These results suggested that use of an arbitrary vaccine interval leads to unneeded vaccination of the majority of cats (7,8).

Optional vaccines currently available for use in cats include *Chlamydophyla felis* (previously *Chlamydia)*, feline leukemia virus (FeLV), feline immunodeficiency virus (FIV), feline infectious peritonitis virus, *Bordetella bronchiseptica, and Giardia*.

Chlamydophila felis infection in cats generally only results in mild conjunctivitis and the zoonotic potential is minimal, and so whether vaccination is ever required is controversial. The use of this vaccine should be reserved for cats with a high risk of exposure to other cats and in catteries with endemic disease. Duration of immunity for *Chlamydophila* vaccines may be short-lived, so high-risk cats should be immunized prior to a potential exposure.

Many cats have antibodies against *Bordetella bronchiseptica* and there are sporadic reports of severe lower respiratory disease due to bordetellosis in young kittens. However, since significance of the problem for pet cats is undefined, *Bordetella* vaccination should be considered

primarily for use in cats at high risk for exposure. In an 11 year period at the Diagnostic Laboratory at Colorado State University, *B. bronchiseptica* was isolated from < 3% of the lower airway cultures and nasal cultures from clinically ill, client-owned cats (Stein J, Unpublished data, 2004). Since the disease is apparently not life-threatening in adult cats, is uncommon in pet cats, and responds to a variety of antibiotics, routine use of this vaccine in client-owned cats seems unnecessary.

Several FeLV vaccines are currently available. Due to difficulties in assessment of efficacy studies it is unclear which vaccine is optimal. FeLV vaccines are potentially indicated in cats allowed to go outdoors or that have other exposure to cats of unknown FeLV status. The vaccines are likely to be most helpful in kittens because as cats age, there is an acquired resistance to FeLV infection that limits usefulness of vaccination. Vaccinated cats should receive 2 vaccinations initially. Adjuvanted products should be administered SQ in the distal left rear limb due to the risk for development of soft tissue sarcomas. Maximal duration of immunity is unknown, so annual or biannual boosters are currently recommended. The vaccines are not effective in persistently viremic cats and so are not indicated. However, administration of the vaccine to viremic or latent cats does not have increased risk of vaccine reaction. FeLV testing should be performed prior to vaccination because the retrovirus serologic status of all cats should be known so appropriate husbandry can be maintained.

A killed vaccine containing immunogens from 2 FIV isolates was recently licensed for use in the United States. In pre-licensing studies, 689 cats received 2,051 doses of vaccine with side-effects detected in < 1%. In a challenge study performed 375 days after inoculation with 3 doses (3 weeks apart), 84%% of the vaccinates did not become FIV- infected and 90% of the controls became FIV-infected giving a preventable fraction of 82%. However, the efficacy and safety of the vaccine has not been assessed under field conditions in large numbers of cats with large multiple FIV strains. Whether the vaccine will induce vaccine sarcomas is currently unknown. The primary problem with FIV vaccination at this time is that the vaccine induces antibodies detectable by the currently available antibody test. Thus, after vaccination, the practitioner will be unable to determine whether the cat is infected by FIV. PCR assays for detection of FIV provirus is available in some laboratories, but standardization and external quality control for laboratories providing PCR testing is not currently performed (9).

An intranasal coronavirus vaccine that may protect some cats from developing feline infectious peritonitis virus infection is currently available. The vaccine appears to be relatively safe. In pet cats, the seroprevalence of coronavirus infection is approximately 20% to 70%, but the incidence of disease due to feline infectious peritonitis virus infection is small. Since the incidence of disease is low, cats are commonly exposed to coronaviruses prior to vaccination, the duration of immunity is short, and the efficacy is less than 100%, coronavirus vaccination is currently considered optional for pet cats. The vaccine may be indicated for seronegative cats entering a known coronavirus-infected household or cattery. The efficacy of this vaccine has not been proven in cats with positive coronavirus serology. Many cats that are to be exposed to coronaviruses have done so by 16 weeks of age and so if used, the vaccine may be more effective at 8 and 12 weeks of age.

A *Giardia* spp. vaccine has been introduced for use in cats. When given twice, the vaccine lessens numbers of cysts shed and lessens clinical disease on challenge with one heterologous strain. While the no significant side-effects were reported in preliminary studies, the vaccine is adjuvanted and given SQ and so may ultimately be proven to be associated with fibrosarcomas. Since the disease is usually not life-threatening and infection is often cleared by treatment, routine use in client-owned cats seems unnecessary. Additionally, it is now known that there are multiple *Giardia* spp., including a feline specific strain (10). It is unknown whether the vaccine is protective against strains other than the one used in challenge studies. Based on a study in dogs (11), it has been proposed that the vaccine may have utility as an immunotherapeutic agent in cats with recurrent or persistent infection. However, in one study of experimentally inoculated cats, the vaccine was ineffective for the treatment of giardiasis (12).

CANINE VACCINATION PROTOCOLS FOR DOGS

Core vaccines include canine distemper virus, parainfluenza, adenovirus 2, and parvovirus (DA2PP). Puppies born to vaccinated bitches and presented at 6-12 weeks of age should be vaccinated every 3-4 weeks until 14-16 weeks of age. Puppies presented between 12-16 weeks of age and adult dogs with unknown vaccination history should be give 2 vaccines, 3-4 weeks apart. High antigen mass, low passage parvovirus vaccines are not needed after 16 weeks of age and are likely to be effective in most puppies that are vaccinated to 12 weeks of age.

Rabies vaccine is administered at 12 or 16 weeks of age depending on local ordinances. In areas in which rabies is endemic and exposure may occur before 16 weeks of age, vaccination at 8, 10, or 12 weeks of age may be indicated.

At one year of age or one year later the dog should return for a DA2PP and rabies booster vaccinations.

After one year of age, risk of infection by canine distemper virus, parainfluenza, adenovirus 2, and parvovirus should be assessed yearly while performing a physical examination and checking for enteric parasites. Serological studies suggest that protective immunity to canine distemper virus and canine parvovirus lasts for years (13,14). Canine parvovirus vaccines may provide life-long immunity and distemper virus titers are detected for up to 10 years in many dogs. Thus, in low risk dogs, modified live DA2PP vaccines should be administered no more often than every third year. One commercially available vaccine is currently labeled for use every third year in adult dogs. However, if recombinant antigens are used, annual boosters may be needed. Positive serologic tests for canine distemper virus and canine parvovirus are predictive of resistance (New York State Veterinary Diagnostic Laboratory, Ithaca, NY) and are used in lieu of arbitrary vaccination interval by some veterinarians.

Optional vaccines for use in dogs with high risk for developing the disease include *Bordetella bronchiseptica, Borrelia burgdorferi, Leptospira* spp., coronavirus and *Giardia.*

Leptospira spp. infections have differences in regional prevalence in the United States. Thus, vaccination is currently recommended most strongly for dogs living in endemic parts of the state or traveling to other endemic areas. Currently available vaccines commonly induce vaccine associated side-effects. If used, *Leptospira*-

containing products with the most serovars are indicated. However, there are serovars in the environment that are not in any vaccines and there is minimal cross-protection between serovars. Thus, it is important that clients realize that even though their dog has been given a *Leptospira* vaccine, 100% protection cannot be guaranteed. Duration of immunity is likely less than one year.

The majority of dogs exposed to *Borrelia burdorferi* do not develop measurable clinical disease. Dogs living in areas endemic for the *Ixodes* tick vector are the most likely to benefit from vaccination. Dogs previously naturally infected with *B. burgdoferi* likely do not benefit from vaccination. Even in endemic areas, the potential for vaccine reaction approximates the potential for developing Lyme disease. Thus, the use of this antigen for the majority of dogs in non-endemic areas is not recommended. Maintaining strict tick control while visiting Lyme endemic areas like Wisconsin or the Northeastern states could be considered in lieu of vaccination. The most appropriate vaccination interval is unknown.

Coronavirus infection in dogs results in mild gastrointestinal disease unless concurrent infection with parvovirus occurs. Experimentally, the virus does not cause disease in dogs after 6 weeks of age. In one study at Colorado State University of dogs with and without diarrhea, only one dog was shown to be shedding coronavirus in feces and it was a healthy control dog (15). The AAHA Canine Vaccination Guidelines Committee considers this antigen to be not recommended in any situation.

A *Giardia* spp. vaccine has been introduced for use in dogs. The vaccine is given to dogs > 8 wks of age, SQ, twice, 2-4 weeks apart. In a clinical study of 755 dogs, adverse reactions were not reported. In challenge study performed 12 months after the second inoculation, only 9 of 20 vaccinates shed cysts, whereas, all 10 placebo inoculated dogs shed cysts. Vaccinates shed cysts for an average of 7 days versus 37 days for placebo dogs. Average number of cysts shed per gram of feces per day was 0.8 and 670, for the vaccinated dogs and placebo dogs, respectively. Prevalence rates of infection vary across the country. On the front range of Colorado, approximately 5% of the dogs are infected (15). It is now known that there are dog specific strains of *Giardia* (10). It is unknown whether the vaccine is protective against strains other than the one used in challenge studies. Since the disease is usually not life-threatening in dogs, is of low prevalence in pet dogs, generally responds to therapy, and is not always zoonotic, the need for routine use in healthy, client-owned dogs has been questioned. It is possible that vaccination will ultimately be shown to aid in the control of giardiasis in endemic kennels, clinics, or shelters. However, administration of the vaccine did not lessen endemic giardiasis in one kennel.

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