UC DAVIS VMTH CANINE AND FELINE VACCINATION GUIDELINES (Revised 12/07)

Introduction

The UC Davis VMTH vaccination guidelines below have been based on recently published studies and recommendations made by task forces (including the AAFP/AFM Advisory Panel on Feline Vaccines, AAHA Canine Vaccine Task Force, and the AVMA Council on Biologic and Therapeutic Agents), which include representatives from academia, private practices, governmental regulatory bodies, and industry. These groups have evaluated the benefits versus risks of the vaccines currently available on the market. Interested readers are referred to documents published by these groups for further information (see References and Resources listed at the end of this document). The document below has been generated by a group of faculty and staff at UC Davis School of Veterinary Medicine for the purposes of VMTH veterinary student education and as a reference for referring veterinarians. *These are only general guidelines*, as the vaccine types recommended and the frequency of vaccination vary depending on the lifestyle of the pet being vaccinated, i.e. indoor vs outdoor pets, travel plans, kennel/boarding plans, and underlying disease conditions such as immune-mediated diseases or pre-existing infections such as FIV infection. Because these factors may change over time, we recommend the vaccination plan for each individual pet be decided by the owner at routine annual examinations, following a discussion between the veterinarian and the client regarding the animal's lifestyle in the year ahead. Guidelines for vaccination in shelter situations can be accessed at the Center for Companion Animal Health's shelter medicine website. A previous history of vaccination reactions in an individual pet will also affect recommendations for vaccination. For all vaccines given, the product, expiration date, lot number, route and location of injection is documented in the record.

It should also be noted that much research in the area of companion animal vaccinology is required to generate optimal recommendations for vaccination of dogs and cats. As further research is performed, and as new vaccines become available on the market, this document will be continuously updated and modified.

I. Canine Vaccination Guidelines

Canine Core Vaccines

Core vaccines are recommended for all puppies and dogs with an unknown vaccination history. The diseases involved have significant morbidity and mortality and are widely distributed, and in general, vaccination results in relatively good protection from disease. These include vaccines for canine parvovirus (CPV), canine distemper virus (CDV), canine adenovirus (CAV), and rabies.

Canine Parvovirus, Distemper Virus, and Adenovirus-2 Vaccines

For initial puppy vaccination (≤ 16 weeks), one dose of vaccine containing modified live virus (MLV) CPV, CDV, and CAV-2 is recommended every 3-4 weeks from 6-8 weeks of age, with the final booster being given no sooner than 16 weeks of age. For dogs older than 16 weeks of age, two doses of vaccine containing modified live virus (MLV) CPV, CDV, and CAV-2 given 3-4 weeks apart are recommended. After a booster at one year, revaccination is recommended every 3 years thereafter, ideally using a product approved for 3-year administration, unless there are special circumstances that warrant more or less frequent revaccination. Note that

recommendations for killed parvovirus vaccines and recombinant CDV vaccines are different from the above. These vaccines are not currently stocked by our pharmacy or *routinely* used at the VMTH. We do not recommend vaccination with CAV-1 vaccines, since vaccination with CAV-2 results in immunity to CAV-1, and the use of CAV-2 vaccines results in less frequent adverse events.

Canine Rabies Virus Vaccines

In accordance with California state law, we recommend that puppies receive a single dose of killed rabies vaccine at 16 weeks of age. Adult dogs with unknown vaccination history should also receive a single dose of killed rabies vaccine. A booster is required one year later, and thereafter, rabies vaccination should be performed every 3 years using a vaccine approved for 3-year administration.

Canine Non-Core Vaccines

Non-core vaccines are optional vaccines that should be considered in light of the exposure risk of the animal, ie. based on geographic distribution and the lifestyle of the pet. Several of the diseases involved are often self-limiting or respond readily to treatment. Vaccines considered as non-core vaccines are canine parainfluenza virus (CPiV), distemper-measles combination vaccine, *Bordetella bronchiseptica*, *Leptospira* spp., and *Borrelia burgdorferi*. Vaccination with these vaccines is generally less effective in protecting against disease than vaccination with the core vaccines.

Canine Parainfluenza Virus and *Bordetella bronchiseptica*

These are both agents associated with kennel cough in dogs. For *Bordetella bronchiseptica*, intranasal vaccination with live avirulent bacteria is recommended for dogs expected to board, be shown, or to enter a kennel situation within 6 months of the time of vaccination. We currently stock the intranasal vaccine containing both *B. bronchiseptica* and CPiV. For puppies and previously unvaccinated dogs, only one dose of this vaccine is required (recommendations differ for the parenteral, killed form of this vaccine). Most boarding kennels require that this vaccine be given within 6 months of boarding; the vaccine should be administered at least one week prior to the anticipated boarding date for maximum effect.

Canine Distemper-Measles Combination Vaccine

This vaccine has been used between 4 and 12 weeks of age to protect dogs against distemper in the face of maternal antibodies directed at CDV. Protection occurs within 72 hours of vaccination. It is indicated only for use in households/kennels/shelters where CDV is a recognized problem. Only one dose of the vaccine should be given, after which pups are boostered with the CDV vaccine to minimize the transfer of anti-measles virus maternal antibodies to pups of the next generation. The UC Davis VMTH does not stock the distemper-measles combination vaccine as situations requiring its use do not arise commonly in our hospital population.

Canine *Leptospira* Vaccines

Multiple leptospiral serovars are capable of causing disease in dogs, and minimal cross-protection is induced by each serovar. Currently available vaccines do not contain all serovars, efficacies against infection with the targeted serovar are between 50 and 75%, and duration of immunity is probably about 1 year. However, leptospirosis is not uncommon in Northern Californian dogs with exposure histories involving livestock and areas frequented by wild mammals, the disease can be fatal or have high morbidity, and also has zoonotic potential. Therefore, we suggest annual vaccination of dogs living in/visiting rural areas or areas frequented by wildlife with vaccines containing all four leptospiral serovars (*grippotyphosa*, *pomona*, *canicola* and *icterohemorrhagiae*), ideally before the rainy season, when disease incidence peaks. The initial vaccination should be followed by a booster 2-4 weeks later, and the first vaccine be given no earlier than 12 weeks of age. In general, leptospiral vaccines have been associated with more severe postvaccinal reactions (acute anaphylaxis) than other vaccines. Whether the recent introduction of vaccines with reduced amounts of foreign protein has reduced this problem is still unclear. Vaccination of dogs in suburban areas with minimal exposure to farm animals or forested areas is not recommended. Anecdotally, the incidence of reactions has been greatest in puppies (< 12 weeks of age, and especially < 9 weeks of age) and small-breed dogs. A careful risk-benefit analysis is recommended before considering vaccination of small breed dogs at risk of exposure to leptospires.

Canine *Borrelia burgdorferi* (Lyme) Vaccine

The incidence of Lyme disease in California is currently considered extremely low. Furthermore, use of the vaccine even in endemic areas (such as the east coast of the US) has been controversial because of anecdotal reports of vaccine-associated adverse events. Most infected dogs show no clinical signs, and the majority of dogs contracting Lyme *disease* respond to treatment with antimicrobials. Furthermore, prophylaxis may be effectively achieved by preventing exposure to the tick vector. If travel to endemic areas (ie the east coast) is anticipated, vaccination with the Lyme subunit vaccine could be considered followed by boosters at intervals in line with risk of exposure. The UC Davis VMTH does not stock the Lyme vaccine or recommend it for use in dogs residing solely in Northern California.

Other Canine Vaccines

Several other canine vaccines are currently available on the market. These are vaccines for canine coronavirus, *Giardia* spp., canine adenovirus-1, rattlesnake envenomation, and *Porphyromonas* vaccine. The reports of the AVMA and the AAHA canine vaccine task force have listed the first three vaccines as not generally recommended, because ‘the diseases are either of little clinical significance or respond readily to treatment’, evidence for efficacy of these vaccines is minimal, and they may ‘produce adverse events with limited benefit’. Currently, information regarding the efficacy of the canine rattlesnake and *Porphyromonas* vaccines is insufficient. The UC Davis VMTH does not stock or routinely recommend use of these four vaccines.

Canine Coronavirus Vaccine

Infection with canine coronavirus alone has been associated with mild disease only, and only in dogs < 6 weeks of age. It has not been possible to reproduce the infection experimentally, unless immunosuppressive doses of glucocorticoids are administered. Serum antibodies do not correlate with resistance to infection, and duration of immunity is unknown. Vaccination against CPV protects puppies against challenge with both CCV and CPV. Therefore, the UC Davis VMTH does not routinely recommend vaccination against CCV and the vaccine is not stocked by our pharmacy.

Canine *Giardia* spp. Vaccine

Approximately 90% of dogs respond to treatment for *Giardia* infection, most infected dogs are asymptomatic, and the disease is not usually life-threatening. The vaccine does not prevent infection but may reduce shedding and clinical signs. The zoonotic potential of *Giardia* remains unclear. Based on existing evidence, the UC Davis VMTH does not currently recommend routine vaccination of dogs for *Giardia* spp, and the vaccine is not stocked by our pharmacy.

Canine Rattlesnake Vaccine

The canine rattlesnake vaccine comprises venom components from *Crotalus atrox* (western diamondback). Although a rattlesnake vaccine may be potentially useful for dogs that frequently encounter rattlesnakes, currently we are unable to recommend this vaccine because of insufficient information regarding the efficacy of the vaccine in dogs. Dogs develop neutralizing antibody titers to *C. atrox* venom, and may also develop antibody titers to components of other rattlesnake venoms, but research in this area is ongoing. Owners of vaccinated dogs must still seek veterinary care immediately in the event of a bite, because 1) the type of snake is often unknown; 2) antibody titers may be overwhelmed in the face of severe envenomation, and 3) an individual dog may lack sufficient protection depending on its response to the vaccine and the time elapsed since vaccination. According to the manufacturer, to date, rare vaccinated dogs have died following a bite when there were substantial delays (12-24 hours) in seeking treatment. Recommendations for booster vaccination are still under development, but it appears that adequate titers do not persist beyond one year after vaccination. Adverse reactions appear to be low and consistent with those resulting from vaccination with other products available on the market. The product license is currently conditional as efficacy and potency have not been fully demonstrated. Based on existing evidence, the UC Davis VMTH does not currently recommend routine vaccination of dogs for rattlesnake envenomation, and the vaccine is not stocked by our pharmacy.

Canine Porphyromonas Vaccine

The canine *Porphyromonas* vaccine is an inactivated *Porphyromonas denticanis, P. gulae* and *P. salivosa* bacterin. It has been marketed ‘as an adjunct to professional dental cleaning, periodontal therapy, and owner-administrated dental care routines’ to prevent periodontitis, as demonstrated by a reduction in bone changes (bone loss/sclerosis) in mice used as an experimental model. The manufacturer recommends that primary vaccination consist of 2 doses given subcutaneously 3 weeks apart. The product license is currently conditional as efficacy and potency have not been demonstrated in dogs. Based on existing evidence, the UC Davis VMTH does not currently recommend routine vaccination of dogs for periodontal disease with this vaccine, and the vaccine is not stocked by our pharmacy.

II. Feline Vaccination Guidelines

In general, guidelines for vaccination of cats have been strongly influenced by the appearance of vaccine-associated sarcomas in cats, and in particular their epidemiologic association with feline leukemia virus vaccines and killed rabies virus vaccines. Thus, there is clear evidence for minimizing frequency of vaccination in cats. The recommendations below have been made in light of the AVMA/AAHA/AAFP/VCS task force recommendations on vaccine-associated sarcomas in cats. Risk factors for sarcomas should be discussed with cat owners at the time of examination. If a cat develops a palpable granuloma at the site of previous vaccination, the benefits vs risks of future vaccinations should be carefully considered. All vaccine-associated sarcomas should be reported to the vaccine manufacturer, the USDA Center for Veterinary Biologics, and the AVMA.

Feline Core Vaccines

The definitions of core and non-core vaccines described in the canine vaccination guidelines above also apply to the feline vaccines. The core feline vaccines are those for feline herpesvirus 1 (FHV1), feline calicivirus (FCV), feline panleukopenia virus (FPV) and rabies.

Feline Herpesvirus 1, Feline Calicivirus and Feline Panleukopenia Virus Vaccines

For initial kitten vaccination (≤ 16 weeks), one dose of parenteral vaccine containing modified live virus (MLV) FHV1, FCV, and FPV is recommended every 3-4 weeks from 6-8 weeks of age, with the final booster being given no sooner than 16 weeks of age. For cats older than 16 weeks of age, two doses of vaccine containing modified live virus (MLV) FHV1, FCV, and FPV given 3-4 weeks apart are recommended. After a booster at one year, revaccination is suggested every 3 years thereafter for cats at low risk of exposure. According to recommendations of the vaccine-associated sarcoma task force, these vaccines are administered over the right shoulder. Note that recommendations for killed and intranasal FHV1 and FCV vaccines are different from the above. Killed and intranasal varieties of these vaccines are not *routinely* used at the VMTH. The use of FPV MLV vaccines should be avoided in pregnant queens and kittens less than one month of age.

Feline Rabies Virus Vaccines

Cats are important in the epidemiology of rabies in the US. In general we recommend that kittens receive a single dose of killed or recombinant rabies vaccine at 12-16 weeks of age. Adult cats with unknown vaccination history should also receive a single dose of killed or recombinant rabies vaccine. For the recombinant vaccines, boosters are recommended at yearly intervals. We currently stock and suggest the use of the recombinant rabies vaccine, although there is no evidence as yet that it is associated with a decreased risk of sarcoma formation. For the killed rabies vaccines, a booster is required at one year, and thereafter, rabies vaccination should be performed every 3 years using a vaccine approved for 3-year administration. According to recommendations of the vaccine-associated sarcoma task force, rabies vaccines are administered subcutaneously as distally as possible in the right rear limb.

Feline Non-Core Vaccines

Optional or non-core vaccines for cats consist of the vaccines for feline leukemia virus (FeLV), feline immunodeficiency virus, virulent FCV, *Chlamydophila felis*, and *Bordetella bronchiseptica*.

Feline Leukemia Virus Vaccine

A number of FeLV vaccines are available on the market, and many have reasonable efficacy, although they do not produce sterilizing immunity. We suggest vaccination of FeLV-negative cats allowed to go outdoors or cats having direct contact with other cats of unknown FeLV status. Vaccination is most likely to be useful in kittens and young adult cats, because acquired resistance to infection develops beyond 16 weeks of age. As of 2006, the AAFP recommends primary vaccination of all kittens for FeLV, but the decision to administer booster vaccines is based on risk assessment. Vaccination is not recommended for FeLV-positive cats and indoor cats with no likelihood of exposure to FeLV. We currently stock and suggest the use of the recombinant transdermal FeLV vaccine, although there is no evidence as yet that it is associated with a decreased risk of sarcoma formation. Initially, two doses of vaccine are given at 2-4 week intervals, after which annual boosters are recommended depending on risk.

According to recommendations of the vaccine-associated sarcoma task force, parenteral FeLV vaccines are administered subcutaneously as distally as possible in the left rear limb.

Feline Immunodeficiency Virus Vaccine

The FIV vaccine is an inactivated, adjuvented dual subtype vaccine that was released in July 2002. Unfortunately, vaccination of FIV-negative cats renders currently available serologic tests (ELISA and Western blot) positive for at least a year following vaccination, and polymerase chain reaction (PCR)-based tests do not reliably identify cats with natural infection. These PCR tests have yet to be standardized, and quality control may be problematic. Previous vaccination does not prevent infection, and the significance of a positive test result in a vaccinated cat cannot be assessed. Questions remain regarding the vaccine's ability to protect against all of the FIV subtypes and strains to which cats might be exposed. Therefore, the decision regarding whether to use this vaccine is not straightforward, and the risks and benefits of the use of this vaccine should be carefully discussed with owners prior to using the vaccine in cats at risk of exposure. The UC Davis VMTH pharmacy does not stock this vaccine, and its routine use in indoor cats is not recommended.

Virulent Calicivirus Vaccine

The virulent FCV vaccine (Calicivax) is a killed, adjuvanted vaccine containing just one of many different strains of hypervirulent FCV known to cause severe systemic disease, including facial or limb edema, cutaneous ulceration, hepatocellular dysfunction, and high mortality. The disease is relatively rare, but has often involved otherwise healthy, adult cats that have been vaccinated with core vaccines containing FCV. In general, outbreaks have been self-limiting with no spread to the wider cat community. Although the virulent FCV vaccine has protected against challenge with the same FCV strain present in the vaccine, no field studies have yet been performed to determine whether it protects against other virulent strains. Given that the degree of serologic cross-reactivity between these strains is low, cross-protection does not seem very likely. Currently we do not recommend or stock this vaccine because 1) it is an adjuvanted vaccine that may increase risk of sarcoma formation; 2) the disease is rare and spread tends to be self-limiting; and 3) the degree of cross-protection between the strain included in the vaccine and other virulent FCV strains is unknown. For more information on this disease, the reader is referred to the Center for Companion Animal Health's Shelter Medicine document.

Feline *Chlamydophila felis* Vaccine

Chlamydophila felis causes conjunctivitis in cats that generally responds readily to antimicrobial treatment. Immunity induced by vaccination is probably of short duration and the vaccine provides only incomplete protection. The use of this vaccine could be considered for cats entering a population of cats where infection is known to be endemic. However, the vaccine has been associated with adverse reactions in 3% of vaccinated cats, and we do not recommend routine vaccination of low-risk cats with this vaccine. The *C. felis* vaccine is therefore not stocked by the VMTH pharmacy.

Feline *Bordetella bronchiseptica* Vaccine

This is a modified live intranasal vaccine. *Bordetella bronchiseptica* is primarily a problem of very young kittens, where it can cause severe lower respiratory tract disease. It appears to be uncommon in adult cats and pet cats in general. For these reasons, the UC Davis VMTH does not recommend routine vaccination of pet cats for *Bordetella bronchiseptica*. The vaccine could be considered for young cats at high risk of exposure in large, multiple cat environments. The UC Davis VMTH pharmacy does not stock this vaccine.

Other Feline Vaccines

Feline vaccines that have been listed as 'Not Generally Recommended' by the AAFP, include the feline infectious peritonitis (FIP) vaccine and the feline *Giardia lamblia* vaccine.

Feline Infectious Peritonitis Vaccine

The FIP vaccine is an intranasal modified live virus product. The efficacy of this vaccine is controversial, and duration of immunity may be short, although the vaccine appears to be safe. Although exposure to feline coronaviruses in cat populations is high, the incidence of FIP is very low, especially in single-cat households (where it is 1 in 5000). Most cats in cattery situations where FIP is a problem become infected with coronaviruses prior to 16 weeks of age, which is the age at which vaccination is first recommended. Vaccination could be considered for seronegative cats entering a cattery where FIP is common. We do not routinely recommend vaccinating household cats with the FIP vaccine, and the vaccine is not stocked by our pharmacy.

Feline *Giardia* Vaccine

A killed *Giardia* vaccine has been marketed for use in cats. This vaccine has the same limitations as those listed above for canine giardiasis, and has the additional potential to induce vaccine-associated sarcomas. We currently do not recommend routine use of this vaccine in pet cats. The UC Davis VMTH pharmacy does not stock this vaccine.

REFERENCES AND RESOURCES/SUGGESTED FURTHER READING

Paul MA, Appel M, Barrett R et al. 2003. Report of the American Animal Hospital Association (AAHA) Canine Vaccine Task Force: Executive Summary and 2003 Canine Vaccine Guidelines and Recommendations. *J Am Anim Hosp Assoc*. 39(2):119-131 (also http://www.aahanet.org via the AVMA Login (green))

Klingborg DJ, Hustead DR, Curry-Galvin EA et al 2002. AVMA Council on Biologic and Therapeutic Agents' report on cat and dog vaccines. *J Am Vet Med Assoc*. 221(10):1401-1407 http://www.electronicipc.com/journalez/mo/viewpdf.cfm?code=04290022211005 [Full Text Article-*JAVMA* subscribers]

Klingborg DJ, Hustead DR, Curry-Galvin EA et al 2001. AVMA's Principles of Vaccination. *J Am Vet Med Assoc*. 219: 575-576 (also http://www.avma.org/policies/vaccination.htm)

The 2006 American Association of Feline Practitioners Feline Vaccine Advisory Panel Report. *J Am Vet Med Assoc.* 229: 1405-1441 (also http://www.aafponline.org/resources/practice_guidelines.htm)

American Association of Feline Practitioners: 2000 Feline Vaccination Guidelines. http://www.aafponline.org/about/guidelines_vaccine.pdf

1998 Report of the American Association of Feline Practitioners and Academy of Feline Medicine Advisory Panel on Feline Vaccines. 1998. *J Am Vet Med Assoc*. 212:227-241

Elston T and Rodan I. 1998. Feline Vaccination Guidelines. *Compend Contin Educ Small Anim Practit*. 20(8):936-941

What You Should Know About Vaccination: a client brochure that emphasizes the importance of vaccines while explaining the factors veterinarians consider when making customized vaccine recommendations. http://www.avma.org/communications/brochures/vaccination/vaccination_brochure_outside.pdf http://www.avma.org/communications/brochures/vaccination/vaccination_brochure_inside.pdf Additional vaccine brochure titles are available at http://www.avma.org/communications/brochures/default.asp

Wallis DM and Wallis JL. 2005. Rattlesnake Vaccine to Prevent Envenomation Toxicity in Dogs. Proceedings of the 77th Annual Western Veterinary Conference, Las Vegas, NV.