

Vaccines and Vaccination Protocols

The advent of canine vaccines has vastly changed veterinary medicine in the last 50 years. There has been a significant decrease in the number of dogs with infectious disease; before the vaccine was developed for distemper, it was the number one cause of death among dogs. Now, where the distemper vaccine is used, cancer is the leading cause of disease-related death. The importance of vaccinations to our dogs' well being cannot be over stated. However, what are the guidelines? What are the "rules" to follow? How do we know how much is "too much"?

The purpose of a vaccine is to mimic an infection so that the immune system is introduced to the pathogens that will cause protective immunity without causing clinical disease. It is meant to ensure a faster, stronger response to the pathogen upon re-exposure. The purpose of re-vaccination is to maintain the immune system's "memory" of that pathogen so that the vaccinated dog continues to mount an attack with every exposure so that the infectious agent does not result in a disease state.

Types of Vaccines

There are several types of vaccines. They include conventional vaccines (modified live and killed), recombinant vaccines (genetically engineered and proteins/ peptides) and DNA vaccines.

Modified live vaccines mimic natural infection. They are based on attenuation (reduction of virulence) of the original virus such that they are limited in their ability to cause illness. The vaccine virus follows the exact same path as the wildtype (original) virus does; replicating and getting distributed throughout the body, exposing all parts of the immune system to the pathogen against which you are vaccinating. This type of vaccine is useful because it generally provides a long-lasting immunity; though it can also inadvertently cause disease if the vaccine is inadequately attenuated.

A **killed** vaccine is made of a virus or a strain related to the virus that has been treated to make it non-viable (incapable of replicating and causing disease). The advantage is that the immune system is presented with all of the viral components, especially with those that are conserved between the different subtypes. However, revaccination is necessary because of the shorter duration of immunity.

Genetically engineered vaccines are among the most advanced vaccines used in human and veterinary medicine. In veterinary medicine, recombinant vaccines involve inoculation with only selected genetic sequences derived from the disease producing

virus or bacteria. The vaccine does not expose the individual dog to the whole organism. In dogs, recombinant vaccines have been found to be very safe, highly effective, and produce a long duration of immunity.

Vaccines that use **proteins or peptides** from the pathogenic virus create vaccines that are highly specific – these vaccines are very pure and adverse reactions are rare. The fact that they are highly specific is also their downfall; they are not ideal for protection from organisms that tend to mutate.

DNA vaccines entail injecting highly specific DNA sequences into muscle in a manner that leads to the production (expression) of specific proteins. These vaccines are effective because they elicit both the humoral (pertaining to antibodies) and cell-mediated immunity. The only DNA vaccine licensed for use in the dog is approved as an aid in the treatment (not prevention) of oral melanoma.

Depending on the vaccine type, different routes of administration are used: injection (parenteral), which can be sub-cutaneous or intramuscular, topical (intranasal) or transdermal (air pressure, through the skin).

Intranasal vaccines are typically modified live viruses and bacteria, and must never be injected. Because they mimic infection best, they provide best immune response. Side effects include mild to moderate clinical signs of disease.

Parenteral vaccines can be either modified live viruses/bacteria (MLV) or killed viruses/bacteria. With MLV vaccines, there is a faster immune response, but there can be side effects, and they should not be used in pregnant bitches. With killed vaccines, there is no risk of shedding, but boosters are necessary and the adjuvant (substance that carries the virus) has been attributed to causing cancer (fibrosarcoma) in cats.

Core Vaccines

Core Vaccines are those that are recommended for all dogs, barring special circumstances. These core vaccines include: distemper, parvovirus, canine adenovirus I/II, and rabies. While parainfluenza is no longer considered a core vaccine, it is generally included in the combo core vaccines and will therefore be discussed here. The following descriptions are taken from the University of Tennessee Breeders' Symposium abstract by Dr. Margret Casal of the University of Pennsylvania.

Canine Distemper Vaccine: Currently, distemper vaccines are modified-live vaccines, which are very effective. It was previously thought that combining distemper and Parvo

in the same vaccine would lead to a decrease or a delay in seroconversion to the distemper component. However, (Dr. Casal's) studies and those from Cornell have been unable to substantiate such claims. If a patient is immune deficient or pregnant, MLV vaccines should not be used, because they may cause disease in the patient or the fetuses, respectively. There is a recombinant Distemper vaccine currently available that could be used for those dogs in which MLV vaccines are not an option.

Canine Parvovirus (CPV) Vaccine: Modified live vaccines are available for dogs. Killed vaccines are no longer available because of poor efficacy. Today's MLV Parvovirus vaccines are less attenuated (new-generation, high-titer, low-passage) than previous ones and are claimed to be able to "break through" maternally derived immunity earlier than the previous generation of MLV parvovirus vaccines. In a recent study 60 mixed-breed pups were vaccinated with these newer versions of the CPV vaccines at 6, 9, and 12 weeks. The results showed that all pups had seroconverted by 15 weeks of age, suggesting a faster response and higher serum neutralization titers. Alternatively, if there are immune deficient animals present, they may contract the disease from the vaccine virus. There are myths about the MLV Parvovirus vaccine suppressing the immune system. However, all of the scientific studies done to date have not been able to substantiate such claims. Another myth is that it is more difficult to immunize Rottweilers and Dobermans against CPV infections. While these dog breeds may develop more serious disease after natural infection, they mount immune responses to an efficacious vaccine just like any other dog. Lastly, Parvovirus outbreaks are not prevented with more frequent vaccination. The only way to prevent outbreaks is with proper hygiene, even if this means foot baths and limited contact. CPV is spread by contact with contaminated shoes, clothes, soil, toys and other dogs, while CDV is passed on almost entirely by direct contact with infected dogs.

Canine Adenovirus Vaccine: Canine Adenovirus (CAV) type 1 causes infectious canine hepatitis and CAV-2 is part of the kennel cough complex. Because of previously reported side effects (Blue Eye) when using CAV-1 vaccines, all vaccine manufacturers now offer attenuated CAV-2 in their vaccines as it provides cross-protection against infections with CAV-1. Parenteral and intra-nasal MLV vaccines are available. Minor side effects are possible with the intranasal vaccine such as nasal and ocular discharge, and allergic reactions to the parenteral vaccine have been reported.

Canine Parainfluenza Vaccine: This old tried and true vaccine comes in a parenteral and intranasal MLV form. It is an effective vaccine in the prevention of this component of the kennel cough complex. Side effects include those seen with intranasal CAV-2 vaccines.

Non-Core (Optional) Vaccines

These vaccines are recommended based on the lifestyle and location of the animal in question and include: leptospirosis, *Bordetella bronchiseptica*, Lyme disease, and parainfluenza virus. Again, the descriptions below are courtesy of Dr. Casal:

Leptospira Vaccines: Because all *Leptospira* vaccines are bacterins, their use may result in allergic reactions. The later the vaccine is administered during the puppy series, the less likely the allergic reaction. Current AAHA (American Animal Hospital Association) guidelines recommend delaying this vaccine, especially in small breeds, until the CORE vaccines are completed. Most current *Leptospira* vaccines contain four different serovars: grippityphosa, canicola, icterohemorrhagica, and pomona. The vaccine is now purified, which may reduce allergic reactions and although titers drop significantly after 6 months, challenge with pathogenic forms of *L. icterohemorrhagica* and *canicola* one year after vaccination did not cause disease. Generally, this vaccine is recommended to be given in spring time, especially for dogs that come in contact with wildlife or city rodents.

Lyme Disease (Borreliosis) Vaccines: Lyme Disease in dogs can be prevented by the use of tick prevention and vaccines. The Lyme vaccines have been criticized by some veterinarians as being ineffective. While it is true that some vaccinated dogs do contract the disease, it appears that vaccinated animals are less likely to contract the disease than unvaccinated animals. Vaccination is generally limited to dogs traveling to or living in high prevalence areas.

***Bordetella bronchiseptica* Vaccine:** This is probably not a very effective vaccine, and there are not enough studies to document either short- or long-term efficacy. However, there are some kennels that require *Bordetella* vaccinations before the dog can be boarded. The intranasal vaccine seems to provide marginally better protection than the injectable form. The dog should receive a booster 2-4 weeks after the initial vaccination, if given the killed injectable vaccine. A single dose of the intranasal vaccine is likely to be sufficient in a puppy older than 14 weeks of age, when the maternal antibodies have dropped to undetectable levels. If a dog goes to a kennel often where *Bordetella* vaccines are required, the following vaccination protocol appears to offer the longest lasting immunity:

Canine Influenza Virus (CIV) Vaccine: In May, 2009, the USDA granted a conditional license for the first vaccine against Canine Flu. This vaccine is expected to reduce incidence, severity and duration of the disease but does not necessarily prevent infection altogether. (Conditional license means it has been proven safe with good signs of efficacy, but additional studies are needed to gather more information. The Canine

Health Foundation has funded Grant 1105: Understanding the Dynamics of Canine Influenza Virus Transmission in Dog Populations and Intervention Strategies for Reducing Transmission, a study which will model the transmission of canine flu in a population with and without vaccination and will be a major component in determining the recommended use of this new canine flu vaccine.) For additional information about this disease, see the Winter 2009 edition of *Discoveries*.

So how do you decide which vaccines to give your dog? You should work closely with your veterinarian to determine the risks involved with each animal – treat the individual patient based on his/her specific needs. Differences in risk of exposure to infectious diseases, age and health of the patient, and potential side effects of certain vaccines, make it next to impossible to recommend one single vaccination protocol for all dogs. Therefore, for optimal protection, each dog should be examined on a yearly basis even if vaccines are not to be given in that particular year. Health and life style changes can be assessed and the dog's vaccination protocol can be adjusted as needed. Dr. Richard Ford of North Carolina State University has assembled a website, www.dvmvac.com that carries the American Animal Hospital Association's guidelines for vaccinations, various definitions and a forum for questions and answers for both dogs and cats.

The Canine Health Foundation has funded research by Dr. George Moore at Purdue University on adverse reactions of vaccines (Grant 779). Visit our website, www.CanineHealthFoundation.org for more information about this study.

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