Causes of Vaccine Failure: Why Vaccinated Cats Still Get Sick

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When a vaccinated animal develops the disease against which it was vaccinated, it is often referred to as vaccine failure. In the vast majority of cases, however, it is not the vaccine that has failed, but an inadequate immune response to the vaccine has occurred. Listed below are some of the main reasons disease may develop in vaccinated animals.

Maternal antibody

> The primary cause of vaccine failure is an interfering level of maternal antibody.

Newborn kittens receive disease protection from their mother through the transfer of antibodies. These antibodies are transferred from the mother through the placenta and through colostrum, the first milk the newborns receive. Antibodies are small disease-fighting proteins produced by certain types of cells called 'B cells.' The proteins are made in response to 'foreign' particles such as bacteria or viruses. These antibodies bind with certain proteins (antigens) on foreign particles like bacteria, to help inactivate them.

The age at which kittens can effectively be immunized is proportional to the amount of antibody protection the young animals received from their mother. High levels of maternal antibodies present in a kitten's bloodstream will block the effectiveness of a vaccine. When the maternal antibodies drop to a low enough level in the kitten, immunity (protection from disease) can be produced through vaccination.

The antibodies from the mother generally circulate in the newborn's blood for a number of weeks. There is a period of time from several days to several weeks in which the maternal antibodies are too low to provide protection against the disease, but too high to allow a vaccine to work. This period is called the window of susceptibility. This is the time when despite being vaccinated, a kitten can still contract the disease. This window of susceptibility can vary widely. The length and timing of the window of susceptibility is different in every litter and between animals in the same litter.

Some vaccines can stimulate active immunity in the young animal even when maternal antibodies are present. One type is called a 'high titer, low passage vaccine.' This modified live vaccine contains a higher number of virus particles (high titer) which are less attenuated (low passage) than the 'average' vaccine. Another type, the recombant vaccine, is made from portions of the genes of the virus or bacteria. Those genes that code for the antigens that produce the best antibody response are combined with a non-disease causing virus so they can enter the cells of the body. Both the high titer, low passage vaccines and recombinant vaccines can generally generate an immune system response in young animals who have a maternal antibody level that would prevent them from responding to an 'average' vaccine. As vaccines improve, we will hopefully be better able to protect kittens throughout their early life.

Insufficient time between vaccination and exposure

A vaccine does not immediately provide protection. It takes several days to a week or more for an animal's body to respond to the vaccine. For some vaccines, an adequate level of immunity usually does not occur until 2-3 weeks after the second vaccination in the series. A young animal is susceptible to a disease if it is exposed to the disease before a vaccination has had time to stimulate the body's immunity. A kitten vaccinated against panleukopenia, and then exposed to the virus several days later would probably develop the disease. In the same way, a vaccine will not provide protection to a kitten who was already exposed to the disease before vaccination.

We have seen that too short an interval between vaccination and exposure to disease can result in the animal developing the disease. In some cases, the same is true if the length of time between vaccination and exposure to disease is too long. Some vaccinations may protect the animal for life. Other vaccines, such as feline leukemia vaccine, produce a protection that lasts only a short time (short duration of immunity). The length of protection from a vaccine varies by the disease, type of vaccine, age at vaccination, and the immune system of the individual animal.

Antibody Titer: We can try to determine if a person or animal has protection from a disease by measuring the amount of antibodies in the blood. The result is often expressed as a 'titer.' The test is usually performed by making a number of dilutions of the blood and then measuring at what dilution there is sufficient antibody to react in the test. For example, a titer of 1:8 (one to eight) means the blood can be diluted to one part blood and seven parts saline and still produce a positive reaction in the test. The higher the titer (1:16 is higher than 1:8), the more antibody is present.

It becomes complicated when we try to interpret these titers. The protective titer for feline panleukopenia is 1:100, however, for canine distemper the protective titer is 1:20. You can not compare titers between diseases - a protective titer for one disease will be different than that for another disease. Also, the titer is only a measurement of one part of the immune system - the antibody level. It does not test the remainder of the immune system which can play a very large role in preventing disease.

Some veterinarians suggest we should measure antibody titers before revaccinating an animal. If the animal has a protective titer, a vaccine would not be given. At this time, the protective titer of many diseases is unknown. For some diseases, the level

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of antibody would not accurately assess the immune status of the animal because other parts of the immune system are more important for fighting off that particular disease. Another problem with titers is that the test will only tell us the animal's status at that point in time. It can not tell us what the animal's status will be 6 months from now. So, how often should we test? Finally, there is always the possibility of laboratory error. A test result may erroneously suggest an animal has a protective titer when he really does not.

Different strain of bacteria or virus

Vaccines only contain specific strains of the virus or bacteria that causes disease. A vaccine produced from one strain may not adequately protect against another strain. This is true for feline calicivirus.

Damage to vaccine

If not handled properly, it is possible that a modified live vaccine could be inactivated. This is a very uncommon occurrence, but could occur if the vaccine was exposed to ultraviolet light, if there was a long time period between when it was reconstituted and when it was used, or if it was not stored at the proper temperature. Manufacturers realize some of the vaccine particles could be reduced through handling and have made allowances for this when determining how many vaccine particles should be included in each vaccine.

Improper administration

Vaccines are developed to be given by a certain route, either intranasally (into the nostrils), subcutaneously (under the skin), or intramuscularly (into the muscle). If a vaccine is administered by a route different from the route for which it was developed, it may not be effective and could cause considerable harm.

The entire dose of the vaccine should be given at one time. Vaccines are not developed to give different doses to different size animals, except in some cases, it is recommended that the dose of intranasal vaccines for kittens be reduced.

Nonadherence to vaccination schedule

Vaccine interference: If too short of a time elapses between doses of vaccines, vaccine interference can occur. It is suggested that if more than one type of vaccine is to be given, they should be given at the same time, not several days apart.

Prolonged interval between vaccinations: To provide the best response, the first time an animal is being vaccinated against a disease, repeated vaccinations are usually given 2-4 weeks after the prior vaccination. The first vaccine more-or-less primes the immune system, and the subsequent vaccination(s) increase the immune response. If a period longer than several weeks occurs between this first series of vaccinations, the immune system is no longer as 'primed' and less of an immune response may result from the subsequent vaccination.

Immunosuppression/immunodeficiency

To provide protection from a vaccine, an animal's immune system must be adequately stimulated by the vaccine. If the animal's immune system is not functioning adequately or is suppressed, as would be the case in animals with certain viral infections, and those receiving certain cancer treatments or very high doses of steroids, the vaccine would not initiate a proper immune response, and would not result in protection from the disease.

Concurrent disease process

Fever has been shown to inhibit the response of the immune system to canine distemper vaccination in puppies. Certain viral infections may also decrease the ability of the immune system to adequately respond to a vaccination. Even stress, such as boarding could decrease a cat's response to a vaccination.

Nutritional deficiencies

Animals who are malnourished, like those who are ill, may not respond adequately to a vaccination. Poor nutrition, such as Vitamin A, Vitamin E, and selenium deficiencies, and restricted protein or calories can result in suppression of the immune system.

Summary

When we examine all of the information about maternal antibodies, the window of susceptibility, immune system response, breed susceptibilities, etc., we begin to see why there are so many different vaccination protocols and why all animals who are vaccinated do not develop adequate protection against disease.

No vaccine produces protection in 100% of the population to which it is given.

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