

The risk of vaccinations and their benefit for feral dogs and cats

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The use of vaccinations for dogs and cats is deemed an essential prophylactic and therapeutic measure to prevent infective diseases. Basically they are to prevent viral infections, but they are more and more used against diseases caused by bacteria (*Bordetella bronchiseptica*, *Chlamydia felis*, *Borrelia burgdorferi sensu lato*), protozoen (*Babesia canis*) or fungi (of the *Trichophyton*- and *Mikrosporum* family) as well. [Duchow et al., 2013]. Missing or incomplete immunisation protection can not only endanger the animal him- or herself, but life threatening diseases can be transmitted to humans, too. [Stoskopf & Nutter, 2004, Duchow et al., 2013]. In Germany the federation of practising vets and its permanent veterinary commission on vaccinations ("Ständige Impfkommision Vet. im Bundesverband praktizierender Tierärzte e. V." (bpt)) have published a guideline for the vaccination of small animals. [Duchow et al., 2013]. It sums up the recommendations regarding the vaccination of domestic animals, pets, in Germany. There is a basic distinction between so-called "core components" and "non-core components". "Core components" are considered such vaccinations that fight agents and viruses from which every animal must be protected at all times. The situation is different for "non-core components". These protect animals from agents and viruses against which they must be protected only under certain circumstances, i.e. when exposition is probable. Among the "core components" in Germany for dogs are leptospirose, hepatitis contagiosa canis, parvovirose, distemper and rabies¹. Concerning cats "core components" are the feline herpesvirus (rhinotracheitisvirus), feline calicivirus, feline panleukopenievirus and rabies¹. For some of these diseases the protection provided by vaccination is only complete after a so-called basic immunisation has been reached. In order to reach that, initially several vaccinations must be administered, according to the instructions of the manufacturer of the vaccination. [Duchow et al., 2013].

This in mind many veterinary surgeons ask the question about the benefit of vaccinations for feral cats and dogs. On the one hand these strays are considered the main carriers of cat and dog epidemics or of life threatening zoonoses for man [Stoskopf & Nutter, 2004; Richards et al., 2006, Duchow et al., 2013; Day, Horzinek & Schultz, 2010; Roebisling et al. 2014]. On the other hand the fact, that these animals have no owners or guardians who take them to the vets at regular intervals, makes vaccinations a laborious or even impossible task. If ever, these animals only get into the hands of a vet in the framework of a castration program for population control. This is the only moment in many animals' lives when they can get veterinary treatment. Not always are animals vaccinated during surgical operations. Vaccinations are costly. Furthermore not every kind of vaccination makes sense, because some animals have already been infected with the corresponding germ. If the clinical picture is not clear and without ambiguity, then the germ would have to be detected by a previous blood check. Furthermore several vaccinations must be repeated in order to achieve basic immunisation. Often this cannot be administered with animals living in the wild or it requires a lot of time and effort. Several vaccinations have been tested on the protection they give after a one-time application. The "American Animal Hospital Association" (AAHA) has published the following results:

Both dogs and cats profit from one single dose of anti-rabies inoculation. It can guarantee protection for a period from one to three years. Furthermore a single application of cat vaccinations against feline herpesvirus (rhinotracheitisvirus), feline calicivirus, and feline panleukopenievirus resulted in a protective immunisation titre of 90% and more. In doing so, the use of a modified live vaccine had better results than the use of inactive vaccines. It is not clear, how long immunisation will last. Because the serological result is not clear [Richards et al., 2006] nothing can be said about the immunisation after a single dose of a vaccine against the infection with the feline leukaemia virus (FeLV). Wilson et al. [2012] confirm this in a more recent study. According to the AAHA not all "core components" concerning dogs have yet been tested on their effectiveness after one single application [Welborn et al., 2011].

Another important factor that must be considered with regard to vaccines is the possibility of intolerance reactions. Because these happen seldom, there are only very few studies. However these are reactions that

can occur in dogs and cats in descending order [Moore, et al., 2005; 2007]:

Dogs: Facial and periorbital oedema, urtikaria, generalised pruritus, vomitus, cardiac arrest, collapse;
Cats: Lethargy with or without fever, local reactions at the site of the vaccination (swelling, inflammation, pain), vomitus, facial and periorbital oedema, generalized pruritus. Earlier studies with cats prove the formation of tumours caused by vaccination [Kass et al., 1993]. For that reason Moore et al. [2007] kept observing the animals for up to one year after vaccination. No cat showed symptoms of the formation of fibrosarcoma at the site of puncture. However both in dogs and in cats the risk of a reaction on the vaccination rose with every new vaccination. Every single new vaccination rose the risk of vaccine reaction by 27%. In general animals with a higher body weight were less prone to intolerance, but the risk of a reaction on the vaccination for dogs under a weight of 5kg was more than four times higher than that of dogs with a weight of more than 45kg. Altogether Dachshunds were the most sensitive dogs to vaccinations. In cats no differences concerning breeds could be noticed. Younger dogs between two and nine months old coped between 35-64% better with vaccinations than middle aged dogs between one and three years. This was less consistent with cats: Cat puppies between two and nine months old had a lower risk of vaccine reaction, the risk was highest between nine and 18 months old and after that sank continuously. Male animals showed less vaccine reactions than female ones. [Moore et al., 2005; 2007]. The influence of sex hormones on the immune system has been observed in different animal species as well as in human females. Oestrogen rises immune reactions, whereas testosterone and its metabolites suppress these reactions. [Beagley & Gockel, 2003; Furman et al., 2014]. The exact mechanisms for that are still unclear. In women's plasma a higher concentration of regulatory T-cells was found [Verthelyi, 2001; Beagley & Gockel, 2003], but also the influence of certain genes is being discussed [Klein, Jedlicka & Pekosz, 2010; Furman et al., 2014]. Animals that have been neutered bear an even higher risk of vaccine reactions. In castrated dogs the risk rises by 27-38%. At first sight this seems contradictory especially in relation to female animals. After all because of castration the dogs have a adjoined production of oestrogen. Obviously castration leads to a reduced concentration of oestrogen and testosterone in the serum which hinders the negative feedback mechanism in the hypothalamus, which leads to the rise of the concentration of FSH (follicle-stimulation hormone) and LH (luteinizing hormone) in the serum. [Olsen, Mulnix & Nett, 1992]. These hormones seem to strongly modulate the immune reaction on vaccination, however the exact mechanisms are still unclear in this case, too.

But how much strain is a vaccination for the animal, when applied during anaesthesia? According to the "World Small Animal Veterinary Association" (WSAVA) in principle vaccinations applied under anaesthesia are not recommended [Day, Horzinek & Schultz, 2010], because vaccine reactions, that would be clearly visible otherwise, might be hidden by anaesthesia. Under anaesthesia there is a higher risk of vomiting and ensuing aspiration. Yet considering stray animals, vaccination under anaesthesia during neutering surgery often is the only option. After surgery the animals are released, which makes further surveillance in order to exclude any reactions on the vaccination impossible. Further stress for the animals can be poor health conditions and the unusual stress situation, caused by catching the animals. Furthermore there is a chance that the immune reaction on the vaccine is modulated by castration [Moore et al., 2007; Day, Horzinek & Schultz, 2010; Welborn et al., 2011].

However lacking alternatives, vaccinating animals during anaesthesia within the framework of castration programs according to AAHA is acceptable [Looney et al., 2008; Welborn et al., 2011]. But the vaccination should be carried out only after surgery, in order to minimize the risk of vaccine reactions being hidden under narcosis to the shortest possible period of time. [Fischer et al., 2007]. Blood samples of cats and of dogs have been examined, who had been vaccinated during surgery under general narcosis. A change of immunity in the sense of insufficient protection provided by vaccination could not be confirmed. [Povey, 1986; Fischer et al., 2007]. Vaccinations against feline panleukopenievirus, felines calicivirus and rabies generated vaccine titres of more than 90% [Fischer et al., 2007].

Summing up it can be said, that feral dogs and cats as part of a spay and neuter program should at least be vaccinated against rabies¹ [Richards, 2006; Welborn et al., 2011; Roebling et al., 2014]. Concerning cats

furthermore vaccinations against feline herpesvirus (rhinotracheitisvirus), feline calicivirus and feline panleukopenievirus seem reasonable, too [Richards et al., 2006; Fischer et al., 2007]. If possible, animals living in the wild should be neutered and vaccinated as soon as possible [Spain, Scarlett & Cully, 2002; Moore et al., 2005; Moore et al., 2007], because at the age between two and nine months old the risk of vaccine reactions is lowest. Animals who have been caught by mistake and who have already been castrated earlier, should, if possible, be vaccinated without anaesthesia. Should that not be possible or should only under anaesthesia be found out, that the animal had already been neutered, then especially the spayed female animals should be supervised after vaccination, because they have the highest risk of a vaccine reaction. The same applies to all breeds of small toy dogs and others breeds with a certain predisposition, as can be found in Dachshunds [Moore et al., 2005; 2007]. An increased risk of feline sarcomas was noted in connection with rabies vaccines with added aluminium and in FeLV-vaccines [Kass et al., 1993]. Up to now no studies have been made that examine the tolerability of single vaccines with regard to the manufacturer and set off the result against the ingredients (aluminium).

In general it must be refrained from a reduction of the volume of the vaccine (vaccine dose) in order to avoid vaccine reactions. The volumes have already been reduced by the manufacturers to a minimum. Using a smaller dose would result in insufficient immunisation [Welborn et al., 2011].

At present there is intensified work going on to create an injection that combines the rabies vaccine with a chemical castration [Wu et al., 2009], in order to reduce personnel expenses caused by castration but also in order to reduce the strain on the strays due to surgery. However the development of a uniform contraceptive vaccine is not mature yet [Levy et al., 2011; Munks, 2012]. Accordingly vaccination alongside the castration of dogs and cats still is the method of choice.

In conclusion it should be repeated, that the general risk of dogs' and cats' vaccine reactions on the whole is pretty low. According to Moore et al. [2005; 2007] 0.004% of all dogs vaccinated during a study showed an intolerance reaction and 0.005% of all cats who were vaccinated. The fact, that reactions exist, does not indicate, that vaccinations are dangerous or not safe. The vaccine reactions that have been described are exceptions [Moore et al., 2005]. Nonetheless these are the cases, that always meet the highest interest both of animal owners and researchers.

¹ Because of the fact, that Germany has been free from rabies since 2008, there is an increasing discussion taking place, whether nationwide vaccinations against rabies can still be justified. For further information please refer to Duchow et al., 2013.

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