A vaccine is a preparation introduced into the body to provide protection (immunity) against a disease. Vaccines are usually developed for diseases that can be debilitating or life-threatening and can be spread between individuals.

How does a vaccine work?

A vaccine is a suspension of micro-organisms (bacteria or viruses) which causes the cat to produce antibodies against the micro-organism. If the cat subsequently comes into contact with the micro-organism, the antibodies are there, ready to fight the infection. This is an immune response. The bacteria or virus in the vaccine has either been killed or altered in some way so that the vaccine stimulates the immune response without causing disease. Vaccines are therefore described as killed, modified live, or sub-unit.

Killed vaccines are less likely to cause disease; modified live vaccines may rarely revert to a virulent form and induce disease. However, as killed vaccines do not generate such a strong immune response, modified live vaccines are used more routinely. Killed or sub-unit vaccines should be used in pregnant animals (if they need to be vaccinated), in accordance with manufacturers' guidelines, or in animals were the immune system is not functioning properly (immunocompromised), for example, in cats infected with feline leukaemia virus (FeLV) or feline immunodeficiency virus (FIV).

What diseases can I vaccinate my cat against?

Currently in the UK vaccines are available against the following diseases:

- **Feline panleukopenia virus** (feline infectious enteritis; feline parvovirus)
- **Feline herpesvirus** (cat flu)
- **Feline calicivirus** (cat flu)
- **Feline leukaemia virus** (FeLV)
- ***Chlamydophila felis*** (formerly known as *Chlamydia psittaci* var *felis*)
- *Bordetella bronchiseptica*
- Rabies

In the USA, vaccines are also available against **feline infectious peritonitis**, **feline immunodeficiency virus**, **ringworm** and *Giardia* species. These vaccines are not currently licensed in the UK.

What vaccines does my cat need?

Vaccines can be divided into core vaccines and non-core vaccines. The core vaccines could be considered essential for all cats (including indoor-only cats), whereas the non-core vaccines are given dependent on the individual cat's requirement for them. Decisions regarding requirement for non-core vaccines may be based on the cat's age, lifestyle and contact with other cats.

Core vaccines

Feline panleukopenia

Feline panleukopenia virus causes a severe and often fatal disease. Vaccination is very effective and has thankfully reduced the incidence of the disease substantially. However, where susceptible populations of cats exist, it is highly infectious. In addition, the virus can survive in the environment. Cats may become infected with canine parvoviral strains.

Feline herpesvirus

Once infected with feline herpesvirus cats will exhibit flu-like signs for a short time. Although the clinical signs resolve, the virus remains latent within the body, giving rise to recurrent episodes of respiratory tract infections and/or eye problems. Stress can induce an episode of the disease. Infection usually requires fairly close contact with other cats, as the virus dries out in the environment. Vaccination reduces spread of the infection from cat to cat (eg, cat shows, boarding catteries, veterinary surgeons' premises) and is thought to reduce the episodes of clinical disease in chronically

infected cats.

Feline calicivirus
Like herpesvirus, calicivirus causes cat flu, often with oral ulceration. Cats may either rid themselves of the disease or become chronically infected. Many different strains of calicivirus exist, with the vaccines being aimed at the more serious strains. The presence of different strains, and the ability of cats to become chronically infected (possibly as young kittens before first vaccination) explains why some cats may still show evidence of calicivirus infection, even though they have been vaccinated. However, as for herpesvirus, vaccination is still recommended to reduce the frequency and severity of clinical signs.

Non-core vaccines

Feline leukaemia virus (FeLV)
FeLV is spread in saliva. Cats can become infected through mutual grooming, sharing food and water bowls, or from bites from infected cats. In addition, kittens may become infected via placental transmission, and the virus may be spread at mating. Multi-cat households or indoor-outdoor cats are at risk of catching this infection. A solitary indoor cat is not and, therefore, would not require vaccination. Blood tests for FeLV antigen may enable identification of the FeLV status of cats in a household, in order to facilitate decision-making regarding vaccination.

Chlamydophila felis
A bacterial infection with *Chlamydophila felis* causes conjunctivitis and upper respiratory tract disease. Young kittens are most susceptible, often at an age when they are too young to be vaccinated. Most cases are managed with appropriate antibiotics, rather than vaccination, but vaccination may be appropriate where there is an endemic problem within a multi-cat household.

Bordetella bronchiseptica
A bacterial infection with *Bordetella bronchiseptica* can cause respiratory tract signs such as coughing or pneumonia. It is one of the agents that may be responsible for 'kennel cough' in dogs. Cats most at risk are those in multi-cat households, or cats that share their environment with dogs. Vaccination of at risk cats may be done routinely, or strategic vaccination may be carried out before boarding in a cattery (especially if the cattery also boards dogs). This vaccine is instilled into the nostrils, rather than given by injection, as it stimulates a local immunity in the respiratory passages.

Rabies
Rabies vaccination is only indicated for animals travelling abroad, as the infection is not an endemic disease within the UK.

How frequently should my cat be vaccinated?

All cats should receive a primary core vaccination course of two injections three to four weeks apart, commencing from around nine weeks of age. The cat's need for non-core vaccines can be assessed at this time. In order to ensure a good level of continuing protection, the first booster vaccination should be given a year after the primary course. Thereafter, the recommended frequency of boosters may depend on individual lifestyle and risk.
The current vaccine manufacturers' recommendations are for annual vaccinations, as the product licenses have been based on immunity studies of one year's duration. Many veterinary surgeons follow these guidelines, as not complying with the licensing regulations could leave them open to assertions of negligence. However, more and more work is emerging that demonstrates that the core vaccines are effective for at least three years. Owners can elect to have their cats vaccinated in a triennial regime, provided that they accept that this does not follow the manufacturers' recommendations (ie, informed consent). It is recommended that an annual health check still be performed, even if the cat does not receive a vaccination each year.

Cats that stay at boarding catteries will require an annual vaccination in order that the cattery's insurance is valid and

because it is one of the higher risk areas. This should be given at least two weeks before boarding.

What problems may be associated with vaccination?

Side effects from vaccines are very rare, especially in view of the thousands of doses that are administered every year. The most common side effects are very mild, and include lethargy, inappetence or tenderness at the injection site. More marked side effects may include vomiting, diarrhoea, lameness, fever, signs of respiratory tract infection, or lumps at the site of injection. Kittens and young cats appear to be more likely to develop problems than older cats. Another adverse effect that may be reported is lack of efficacy. Whilst this may be due to genuine vaccine failure, it may also be due to infection before vaccination, or a deficient immune system resulting in an inability by the cat to mount an immune response.

The side effect that has received the most attention in recent years is fibrosarcoma – this is a tumour that develops at the site of vaccination. A number of cats may develop a small nodule at the site of injection, associated with inflammation. This will normally disappear within three to four weeks, but if it does not, the chronic inflammation can lead to the development of a fibrosarcoma tumour. Inflammation is more likely to arise with vaccines that contain a substance called an adjuvant which is included in the vaccine to improve their efficacy. Adjuvanted vaccines are typically the FeLV and rabies vaccines.

The incidence of fibrosarcoma in the USA is estimated to be one case per 10,000, whereas in the UK it is estimated to be 0.04 cases per 10,000 doses of vaccine. This difference may be explained by different vaccines available in the two countries, and the greater frequency of rabies vaccination in the USA.

Injection-associated fibrosarcomas are very invasive, which makes them difficult to remove. In the USA, some guidelines recommend rabies vaccinations are administered in the right hind leg, and leukaemia vaccines are administered in the left hind leg. This is partly because, should a fibrosarcoma develop at these sites, limb amputation is possible and offers a better chance of complete removal than trying to remove an invasive tumour from the neck region.

While fibrosarcoma is a devastating disease, it should be remembered that FeLV is also a fatal disease. The incidence of FeLV is far greater than fibrosarcoma, at one to two cases per 100 cats, with some areas having a much higher prevalence of disease.

Conclusions

Vaccination is generally a safe procedure that has substantially reduced the incidence of serious disease within the feline population. That said, vaccines are not entirely without risk, and appropriate and judicious use is indicated. Individual cats that do not tolerate vaccines may still be protected if the vast majority of the feline population is protected, as the infections do not have sufficient numbers of susceptible hosts to become established. However, if a sufficiently high number of cats were to be unprotected, diseases such as panleukopenia that are currently very rare could become re-established within the feline population.

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