Vaccination is a key component of preventing infectious disease in individuals as well as reducing the risk of exposure to (and by) others. Similarly, testing for the presence of feline leukemia virus (FeLV), feline immunodeficiency virus (FIV), heartworms and intestinal parasites allows us to treat and/or protect individuals and others, including human companions, from infection by some of these agents. The American Association of Feline Practitioners (AAFP) has produced and updated guidelines addressing vaccination recommendations as well as retroviral testing and management (www.catvets.com).

**Vaccination guidelines, AAFP 2013**

Immunization may be described as a method of enhancing or influencing the immune system and developing resistance to infectious disease by inducing the body to produce antibodies and/or immunologically sensitized cells. A vaccine consists of material administered to induce immunity and is a preparation of weakened (attenuated), killed or immunologically active subunits of active virus or bacteria, which are unable or unlikely to cause the disease against which they are designed to protect. Vaccines are usually administered parenterally by injection or by a mucosal route.

The following is an attempt to summarize the key points of the document. Vaccines continue to play an important role in the control of feline infectious diseases in an overall preventative health care program for cats.

1. Vaccinations should be selected for each patient based on risk of exposure to specific pathogens. Risk factors should be re-evaluated at least once a year as changes in the health or lifestyle of the cat may warrant modifications in vaccinations.

<table>
<thead>
<tr>
<th>Patient risk factors</th>
<th>Agent risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Pathogenicity of agent</td>
</tr>
<tr>
<td>Maternal antibody interference</td>
<td>Magnitude of exposure to agent</td>
</tr>
<tr>
<td>Immunosenescence</td>
<td>Geographic prevalence</td>
</tr>
</tbody>
</table>

2. **Core** vaccines are those recommended for administration to every cat because of a) severity of disease, b) transmissibility between animals and/or c) zoonotic potential. As such, panleukopenia (FPV), feline viral rhinotracheitis virus (FHV-1), feline calicivirus (FCV) and rabies are considered core vaccines for cats. In the newest version of the Guidelines, feline leukemia virus (FeLV) is core in kittens for their first year of life as well as boosting at one year of age.

3. **Non-core** vaccines should be administered to cats in specific risk categories on the basis of an individual risk/benefit assessment. Rabies, FeLV in adults after the first anniversary booster, feline immunodeficiency virus (FIV), Chlamyphila felis, Bordetella bronciseptica, and feline infectious peritonitis (FIP) vaccines fall into this category.

4. Vaccination against **rabies** is essential (core) in regions where it is required by statute/law or where the virus is endemic.

5. The Advisory Panel recommends that all cats under 1 year of age be vaccinated against **FeLV** and receive a booster vaccination 1 year later. After 1 year of age, the need for subsequent vaccination is determined by risk factors that the individual is exposed to.

6. While vaccine administration is not an innocuous procedure, the benefits of vaccination far outweigh the risks for the majority of cats. We must continue to vaccinate our patients to prevent recrudescence of infectious diseases we now control. The objective of feline vaccination protocols should be to vaccinate each cat only against infectious agents to which he/she has a realistic risk of exposure; to vaccinate against infectious agents that cause significant disease; the vaccinate a cat only when the potential benefits outweigh the potential risks; to vaccinate each cat no more frequently than necessary; to vaccinate the greatest number of cats possible in the population at risk; and to vaccinate appropriately to protect human/public health.
Rather than being viewed as a routine requirement and the driving force behind the annual visit, vaccination should be a carefully considered medical procedure discussed thoroughly with the client. At each visit, vaccination requirements should be revisited as risk factors for that patient change through life.

When developing a vaccination protocol for an individual cat, the following questions may be considered. Is this individual at risk for this disease? Does this disease have high morbidity? Is it readily treatable? Realistically, could this agent cause fatal illness? It may be inappropriate to use a vaccine against a disease that is rare or against a disease that is not associated with a high morbidity. What kind of protection do I expect from this vaccine (prevention vs. decreased severity of illness)? What side effects or adverse reactions might this vaccine cause? How long does immunity last and when did this cat last receive this vaccine? Each infectious agent is different: in general those that cause severe systemic disease result in lifelong immunity (e.g., panleukopenia) whereas those causing superficial infections produce more transient immunity or a carrier state following recovery (e.g., FHV-1).

Why should we have concerns about over-vaccinating? Arguably, the most alarming one is the risk of feline injection-site sarcoma (FISS) development, however, valid concerns have been raised that over-exposure of the immune system to antigens may over-sensitize a predisposed individual to the risks of hypersensitivity reactions. Administration of any vaccine or other “medication” is never completely without risk. The benefits of the procedure must be weighed against the possible risks. The most common vaccine reactions are local ones such as pain, local swelling or hair loss at the site of injection. Malaise with low-grade fever and lethargy are not uncommon. Hypersensitivity reactions may occur from the most severe and life-threatening, anaphylaxis (Type I, more common with killed vaccines), a local inflammatory reaction (Type III), or a Type IV reaction with granuloma formation. The use of multiple antigens may also cause a transient immunosuppression during the post-vaccinal period, the same period during which one is attempting to induce immunity!

The incidence of soft tissue sarcomas has increased in cats since the late 1980s and parallels the introduction of widespread FeLV vaccination as well as the mandatory use of longer acting, more potent rabies vaccines. In epidemiological studies it was shown that cats receiving FeLV vaccines had a 5.5 fold increased likelihood of developing a sarcoma at an injection site and that cats receiving rabies vaccine had a twofold increase in risk compared to cats receiving no vaccines. It was calculated in the initial study by Kass, that one to three sarcomas developed per 10,000 doses of FeLV and rabies vaccine administered. Other studies place the rate of risk lower or higher but numerous studies have confirmed the causal relationship between vaccination and sarcoma formation in cats. Additionally it was observed that the risk increased with the number of doses of vaccine administered to a given cat at one time: a 50% increase following one vaccine, a 127% increase after two doses and a 175% increase following three or four vaccines given simultaneously. It should not be concluded that only FeLV and rabies are involved, however, as other antigens have been implicated as well. The Vaccine Associated Fibrosarcoma Task Force (VAFSTF) investigated the pathogenesis of these dreadful reactions. One component appears to be malignant transformation of reactive fibroblasts in the presence of adjuvant. Meticulous investigation has confirmed that neither FeLV, FIV nor feline sarcoma viruses are present in these tumours. Nevertheless, the risks of developing an FISS are still lower than the risk of developing FeLV or rabies if exposed. Other injections and foreign bodies can cause sarcomas, as well. Clients should be informed of the risks of vaccinating and of not vaccinating. The following websites are helpful for informing the concerned client about FISS: www.catshots.com, www.avma.org/vafstf/default.asp

Considerations and management options to reduce the risk for the development of FISS are summarized below:

<table>
<thead>
<tr>
<th>Action Suggested</th>
<th>Objective</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend/administer vaccines on the basis of reasonable risk for exposure to the infectious pathogen.</td>
<td>To avoid unnecessary vaccination of cats</td>
<td>Studies have suggested that risk for FISS increases as the number of vaccines received over time increases.</td>
</tr>
<tr>
<td>Administer vaccines only as frequently as needed to provide protective immunity</td>
<td>To avoid unnecessary vaccination of cats</td>
<td>Administer FPV-FHV-1-FCV no more often than every 3 years except in high-risk situations</td>
</tr>
<tr>
<td>Administer parenteral feline vaccines by the SC route only</td>
<td>To facilitate early detection of tumor</td>
<td>Vaccine administered by the IM route does not reduce the risk of tumorigenesis and may delay the detection of a mass located within muscle (vs. skin). It is recommended that all parenteral vaccines be administered by the SC route</td>
</tr>
<tr>
<td>Use recommended vaccination sites</td>
<td>To facilitate complete tumor removal by limb amputation in the event FISS develops</td>
<td>See Vaccination Site Recommendations on page 798 of document.</td>
</tr>
<tr>
<td>Consider vaccine type</td>
<td>To reduce the risk of chronic local inflammation at the injection site which may occur in some cats.</td>
<td>The role of adjuvants in the pathogenesis of FISS, including those containing aluminum, is not clear. Both adjuvanted and non-adjuvanted vaccines induce local inflammation, although the magnitude and type of inflammation varies among vaccines, adjuvants, and individual cats. However, some authors recommend considering non-adjuvanted vaccines to try to reduce local inflammation</td>
</tr>
</tbody>
</table>
| Biopsy of a post-vaccination “lump”: The “3-2-1 rule” | To establish the presence or absence of malignant tumor formation as early as possible | Perform an incisional (vs. excisional) biopsy if a lump:
a. persists for 3 months or longer after injection; or,
b. ever becomes larger than 2 cm in diameter; or,
c. continues to increase in size 1 month after injection |
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<tr>
<td>Perform additional assessment pre-surgically when FISS is confirmed</td>
<td>To evaluate the feasibility of attempting definitive treatment</td>
<td>Tumors are locally aggressive; thoracic metastasis occurs in over 25% of cases. Thorough pre-surgical evaluation of individual cases, including physical and laboratory assessment, thoracic radiography (and other imaging as indicated), is recommended prior to surgical excision</td>
</tr>
<tr>
<td>Remove tumor surgically</td>
<td>To completely excise the tumor</td>
<td>Surgery offers the best opportunity for cure. Radical surgery is usually required to prevent recurrence. Local excision (“lumpectomy”) of FISS is not recommended. In addition to surgery, radiation therapy and/or chemotherapy may be recommended based on consultation with an oncologist</td>
</tr>
</tbody>
</table>

FISS = Feline injection-site sarcoma, SC = subcutaneous, IM = intramuscular; Taken from 2013 AAFP Feline Vaccination Advisory Panel Report

What about the virulent strain feline calicivirus (VS-FCV) vaccine? The AAFP suggests in the Virulent Calicivirus Information Brief that veterinarians consider the information provided in the Feline Vaccine Advisory Panel Report and the following information when making a decision concerning use of FCV containing vaccines:

- The incidence of VS-FCV associated disease in the United States or other countries is unknown.
- VS-FCV strains appear to arise from mutations; so far, each of the outbreak strains appears to be genetically and antigenically distinct from others.
- It is currently unknown whether administration of CaliciVax™ results in protection against heterologous VS-FCV strains on challenge.
- The maximal duration of immunity of CaliciVax™ for homologous or heterologous VS-FCV strains is unknown.
- Use of multiple FCV strains in feline vaccines may increase cross-protection capabilities but results of serum neutralization tests of FCV strains in vitro may not necessarily correlate to protection on challenge.
- Inactivated vaccines may induce protection more slowly than modified live vaccines and so if an inactivated FCV containing vaccine is to be used in the primary immunization period for cats at high risk of exposure to feline panleukopenia virus, it should be used in combination with a parentally administered modified live feline panleukopenia virus containing vaccine.

AAFP feline retrovirus management, key points from the 2008 document

FeLV and FIV are among the most common infectious diseases of cats. Although vaccines are available for both viruses, form the cornerstone for preventing new infections. Currently, the majority of cats are never tested for FeLV or FIV during their lifetime, resulting in thousands of new cases each year.

Testing for FeLV and FIV: All cats should be tested at appropriate intervals based on risk assessment.

- Test new cats entering a household or group housing as in shelter or cattery settings. Test again at least 60 days later, limiting exposure to other cats if possible during that time.
- Test if exposed to a retrovirus infected cat at least once, 60 days after exposure.
- Test all sick cats, regardless of previous test results.
- Test before initial vaccination for FeLV or FIV.
- Consider annual retesting of cats that remain at risk for infection, regardless of vaccination status.
- Always confirm an initial positive retrovirus test.
- Cats that donate blood or tissue should be tested for FeLV by real-time PCR to rule out regressive infection that may be transmissible via transfusion or transplantation.
- Testing healthy feral cats in trap–neuter–return programs depends upon resources and program goals.

Vaccination and other preventative measures

When To Consider FeLV Vaccination:

- Vaccination of all kittens is highly recommended.
- Vaccinate cats that have direct contact with cats of known positive or uncertain status, such as outdoor cats and group housing foster or shelter situations.
When To Consider FIV Vaccination:

- Cats living with FIV-positive cats, particularly if there is fighting.
- Cats that go outside and fight.
- It is unknown whether the vaccine provides cross protection against the many heterologous strains of the virus.
- NOTE! Cats vaccinated with the current FIV vaccine will test positive for FIV antibodies. Visible (collar) and permanent (microchip) identification is recommended for all cats to facilitate reunification should cats become lost. This especially important for cats vaccinated against FIV since a positive test in an animal shelter may result in euthanasia.

Isolation of infected cats using screen or chain link fence barriers is adequate to prevent the transmission of retroviruses. Detergents and common hospital disinfectants effectively inactivate retroviruses. Using sterile or single-use items will deter iatrogenic infections. All blood donors should be tested at least annually.

Management considerations

Retrovirus-positive cats may live many years without related illness. A decision about euthanasia should not be made based on a positive test alone.

- Retrovirus-positive cats should be evaluated by a veterinarian twice a year. In addition to a thorough physical exam, a minimum database including a complete blood count, chemistry panel and urinalysis should be performed at least yearly. Cats with FeLV may have complete blood counts performed twice yearly due to their increased risk of hematological diseases.
- Utilize aggressive diagnostic and treatment plans early in the course of any illness.
- Retrovirus positive cats should be spayed or neutered, housed indoors, and should avoid raw food diets.
- Few large controlled studies have been performed using antiviral or immunomodulating drugs for the treatment of naturally infected cats. More research is needed to identify best practices to improve long-term outcomes following retroviral infections in cats.

Recommendations specific to cattery, shelter and rescue situations are found in the full text of the vaccination as well as the retrovirus management guidelines at www.catvets.com => Veterinary Professionals => Practice Guidelines => Guidelines Publications.