

GUIDELINE for Good vaccination practices

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Preamble

“To vaccinate as many cats as possible, but the individual cat only as often as necessary” is the motto, that has been established worldwide and is, and will remain, the philosophy of ABCD.

Although an annual vaccination schedule was adopted initially in cats, triennial vaccination (i.e. at three-year intervals) has been recommended for some vaccine components for several years. More recently, regular triennial revaccination has been challenged for some core components; instead an individual vaccination schedule, tailored according to the risk in the cat and antibody status, is recommended when feasible (see also the ABCD guidelines on vaccination and antibody testing [HERE](#)) and evaluated during an annual health check.

In addition to the vaccination schedule, several other factors are crucial for the success of vaccination, such as induction of a protective immune response.

In this guideline, practices are recommended to ensure maximum vaccination efficacy. Furthermore, several precautions to eliminate unwanted adverse effects of the vaccines are summarized. As there is only limited published literature on this topic, most recommendations are not evidence-based but rather based on expert opinions.

Factors that affect vaccination efficacy can be defined at different levels: the cat, the vaccine, application of the vaccine, vaccination documentation, vaccination schedule and adverse vaccination effects.

The cat

Pre-vaccination

Educational suggestions for improving owner adherence to the vaccination schedule

In order to vaccinate as many cats as possible owner adherence to the vaccination schedule, tailored to individual cats, is fundamental. However, despite the improving quality of feline medicine that exists, cats worldwide generally receive a lower level of medical care compared to dogs, and this includes care around preventive health care check and vaccinations (Freiwald et al., 2014; Gates et al., 2019; Eschle et al., 2020). One reason reported by cat owners for avoiding veterinary visits is the distress seen in many cats when they are carried out of their home. Continuous meows, panting, scratching the door, vomiting, defaecation and urination are common manifestations occurring during transportation of a cat in a carrier from their home to a vet. Moreover, after returning home, hiding for hours or up to 1-2 days and, in multi-cat households, aggression by other cats can occur. This typically happens when cats are not used to being transported from home, and when they only go to the vet following transportation, which is where negative experiences can occur. Cat owners should therefore be encouraged to accustom their cat to carriers in the home and also transport their cats in the car from an early age and on a regular basis, as do dog owners with their puppies. Moreover, exposure to positive experiences of young pets in the clinic should be promoted by bringing them to the vets to receive treats, toys, and pampering (Riemer et al., 2021). Careful transportation of cats requires closed comfortable carriers suppressing visual stimuli, and with a removable top half to let them stay in the bottom, at least at the beginning of the visit. Negative associations with the carrier have to be avoided and this can be helped by having the carrier available in the home as a place for the cat to rest undisturbed and receive treats. Great resources for owners for preparing for veterinary visits are available [online](#) from charities such as International Cat Care.

Preventive spraying of the interior of a carrier with a synthetic feline facial pheromone product can help reduce stress-related behaviors in cats during transportation. In fact, a significant decrease in stress-related responses was found in a randomized, blinded, placebo-controlled pilot study, particularly in cats with higher stress scores (Shu and Gu, 2021). Single oral pre-appointment drug administration (e.g., with gabapentin or pregabalin) was also able to reduce signs of anxiety in cats during transportation (van Haaften et al., 2017; Lamminen et al., 2021) and gabapentin was found to improve cat compliance in cat undergoing a veterinary clinical examination (van Haaften et al., 2017). However, both drugs are currently not licensed for treating cats and at present their use should be restricted to fearful individuals.

On the veterinary practice side, vets and veterinary nurses and associated staff should be prepared to reduce the stress associated with veterinary visits in cats and to promote positive associations; it is important to have a cat friendly attitude and offer a cat friendly team and environment, including the use of a feline pheromone fraction product on the clinic examination table to reduce stress (Pereira et al., 2016; Rodan et al., 2011). Reducing the level of stress induced by the veterinary visit will produce a benefit for all involved parties: the cat, the owner and the veterinary team (Riemer et al., 2021) and will favour adherence to future prevention measures such as vaccinations.

Pre-vaccination interview with the owner

Vaccination is a medical procedure requiring a pre-vaccination interview to focus on the cat's individual level of risk of exposure to pathogens preventable with vaccines, the health status of the cat, and other specific information.

Apart from the origin of the cat/kitten, all the other information has to be collected at every occasion as changes can occur anytime. History about lifestyle is investigated by specific questions about access to outdoors, multi-cat housing, hunting activities, housing with dogs, and travelling. However, the possibility of a change in the cat's lifestyle during the following year should be checked.

The presence of immunocompromised people (including elderly people and young children) in the household should be investigated. In such situations specific recommendations, e.g., on ectoparasite prevention, should be given, and in addition, some vaccines (e.g., the live vaccine for *Bordetella bronchiseptica*) are not recommended.

Finally, any previous adverse reactions to vaccination must be recorded and considered in decision-making regarding vaccination and the use of possible premedications in the future.

General information that should be collected includes data on any changes in appetite, water consumption, micturition, nutrition (diet and rationing) and administration of any regular antiparasitic treatments (including endectocides), and the cat's current and past health status, in order to be aware of any acute or chronic diseases.

However, the annual health check interview is also an educational opportunity to raise owner awareness about the importance of an annual "health check consultation" for prevention and early diagnosis of medical problems and assessing the need for vaccination.

Physical examination and laboratory investigations

Physical examination, to assure that the cat vaccinee is healthy and can respond to vaccination, is part of the annual health check. This includes identity microchip reading, determination of body condition score, muscle condition score, body weight (it is important to keep a continuous record of body weight for comparison with previous visits, rather than have a computer program that simply updates weight to the current status), temperature, and blood pressure, among others.

A complete blood count, serum biochemistry and urinalysis are indicated at least in mature and older cats. However, urinalysis can also be included in the annual health check of younger cats starting at one year of age because of the good cost-benefit ratio (e.g. for early diagnosis of chronic kidney disease and feline lower urinary tract disease) due to urine being accessible without invasive sampling techniques (owners can be easily educated to collect a sample from the litter box with non-absorbable litter). Blood collected should also be used for testing for FeLV/FIV if the cat has been at risk of exposure (see also the ABCD guidelines on feline leukaemia virus infection [HERE](#) and on feline immunodeficiency virus infection [HERE](#)) and anti-feline panleukopenia virus (FPV) antibody testing to predict level of protection present for FPV (see also the ABCD guideline on vaccination and antibody testing [HERE](#)).

A combined owner and veterinary decision about the vaccination protocol/schedule required in the cat can be decided at the end of the consultation following obtaining the above results.

The vaccine

Vaccines are complex biological medicinal products. Those available and commonly used in cats belong to one of four main classes: modified live virus (MLV) vaccines, inactivated, usually adjuvanted full virus vaccines, subunit vaccines and vector vaccines. Nucleic acid vaccines (RNA or DNA vaccines) are not currently available for cats, but the impressive success of the mRNA vaccines against COVID-19 will certainly lead to a new generation of cat vaccines based on this technology.

MLV vaccines contain infectious viruses, which start to replicate in the cat following administration, inducing an immune response. Inactivated vaccines, and subunit vaccines, which only contain one structural protein (i.e. a “subunit”) of a virus particle, are not infectious but interact directly with immune cells. While inactivated vaccines and subunit vaccines induce predominantly antibodies against the vaccine components, MLVs and vector vaccines will initiate both humoral and cellular immunity, generating antibodies and cytotoxic T cells, respectively, directed against the viral antigens.

A particular modification of a MLV vaccine is a vector vaccine, in which the immunodominant protein of a virus is expressed by a vector virus, e.g., canarypox virus. When the vector virus replicates, the foreign protein is expressed along with the vector virus proteins and is therefore presented as a *de novo* synthesized protein to the immune cells. For an efficient immune response to occur, the vector virus has to infect the cat, but the vector virus replication is blocked at a specific stage in the viral replication cycle. Therefore, no infectious virus particles are formed and no vector virus is shed by the vaccinated cat.

Although MLV vaccines and inactivated vaccines are fundamentally different, they are both fragile and generally need an intact cold chain for supply. Even if the vaccines are lyophilized, storage at low temperatures (2-8°C), but above 0°C, is required and storage and temperature monitoring best practice should be followed, see [HERE](#). Vaccines should not be frozen, unless it is explicitly stated on the package leaflet that it is safe to do so. It might be necessary to transport vaccine vials out of the clinic, for example when vaccinations are carried out at catteries. In this case, there is a real risk of unknowingly freezing vaccine vials when they are transported with coolant packs. The use of conditioned frozen water bottles, as well as insulating material between the bottles and the vials, will keep refrigerated vaccines inside appropriate containers at the right temperature and prevent them from freezing (see [HERE](#)). Additionally, a temperature monitoring device should be used inside the vaccine container to ensure that the required temperatures are maintained.

After reconstitution of lyophilized vaccines, some of these vaccines can lose their immunogenicity rapidly. Thus, reconstituted vaccines should always be used within the time period after reconstitution specified in the package instructions. These conditions should be considered primarily for (most) MLV vaccines and to a lesser extent for inactivated vaccines.

Even with appropriate storage, vaccines can lose their immunogenicity and should not be used beyond the expiry date indicated on the vial or the package leaflet.

If a vaccine dose is taken from a bottle containing more than one dose, it must be ensured that the remaining vaccine doses in the vial are not contaminated by bacteria. Therefore, the vial rubber plug should be disinfected before puncture, and the needle should be removed from the bottle after withdrawing the vaccine dose. A new needle should always be used for vaccinating the cat. However, multi-dose vaccines (multiple dose vials) are generally not recommended for cats due their higher risk to cause feline injection-site sarcoma (FISS) (see also the ABCD guideline on FISS [HERE](#)).

The various vaccine companies often use different vaccine strains of a given virus in their vaccines. However, for most of the feline vaccine viruses, the antigenic differences between them are tiny and most likely not important. To change brands during a vaccination schedule is acceptable, except for feline calicivirus (FCV) vaccines containing different strains.

However, if multivalent vaccines are used, which contain several antigens, the same vaccine combination should always be used for the booster vaccination to ensure the maximum immune response to all components of the vaccine.

Vaccines can only be used if they are licensed by the respective national or international body. In Europe, this is the EMA (European Medicines Agency) in Amsterdam or the corresponding national institution, such as the Paul-Ehrlich-Institut in Germany.

The licence covers exclusively the original formulation of the vaccine. The dilution or mixing of vaccines is not permitted unless the dilution or mixing has also been licensed. The latter is of particular importance as it allows the tailored vaccination of an individual cat only with the components required for that individual cat, and to omit other components of a multivalent vaccine that are not required.

Administration of the vaccine and post-vaccination measures

Before administration, the vaccine should be allowed to warm up to room temperature. Vaccines have to be used according to the instructions given on the package leaflet, which is part of the licence. Intranasal vaccines must be applied intranasally, and parenteral vaccines by injection parenterally.

A parenteral vaccine should be applied strictly subcutaneously; intramuscular (see also the ABCD guideline on FISS [HERE](#)) or even intravenous administration must be avoided. A rare adverse effect of vaccination, as well as other injections or trauma, in cats is FISS. Administration of vaccines (or other injections) between the scapulae is therefore generally not recommended because complete tumour resection is almost impossible in this location, should a tumour develop. Instead, it is recommended to inject the vaccine distally in a leg because, as a possible subsequent treatment of FISS, amputation of the leg can be effective to save the life of the cat (see also the ABCD guideline on FISS [HERE](#)), since FISS tumours are very difficult to excise completely and often recur after resection.

If, for any reason active vaccination (using a MLV or inactivated vaccine) and hyperimmune serum have to be applied at the same time, the two components must be injected at different sites. The hyperimmune serum and the vaccine should never be mixed in one syringe, as this will neutralize the vaccine virus and render the vaccine ineffective.

Owners have to be informed about potential adverse reactions and post-vaccination measures (see also the ABCD guideline on adverse reactions to vaccination [HERE](#)).

In the short term it is recommended to restrict free-roaming of outdoor cats and monitor them for the first 24 hours after vaccine administration. Any adverse reactions must be reported to the relevant national pharmacovigilance authorities (see [HERE](#)).

Vaccination documentation

The vaccination card provides the animal owner and the veterinarian with a summary of the vaccination history of the animal and helps to define the need for re-vaccination in the individual cat.

It is also important to record vaccination-relevant treatments or test results, such as immunosuppressive treatments or antibody status determination, any adverse reactions and the batch and expiry date of the vaccine used.

For cats that travel within Europe, the pet passport is an official document that is mandatory according to the EU directives 576/2013 and 577/2013, mainly to ensure that the cat can be identified and is protected against rabies.

The cats have to be identified by identity microchipping and the corresponding passport, which can only be issued by authorized veterinarians. The cat must have a valid rabies vaccination, as outlined in the directive EU 576/2013. In brief, the anti-rabies vaccine should have been administered by an authorized veterinarian, the cat needs to have been at least 12 weeks old on the date on which the rabies vaccine was administered, and at least 21 days should have expired following the completion of the rabies vaccination protocol required by the manufacturer for the primary vaccination, and be within the period of protective immunity, which is generally three years, for the vaccine to be recognised. Cats younger than 15 weeks of age are not allowed to travel within the EU, as the minimal age of rabies vaccination is 12 weeks, and only 21 days after vaccination is full and reliable protection formally defined.

Cats that travel to countries outside the EU need to fulfill additional requirements for entry into the respective countries.

Vaccination schedule

For detailed information on recommended vaccine schedules see the ABCD tool “Vaccine recommendations” (see [HERE](#)). Special information is provided in the ABCD guidelines for “Vaccination of immunocompromised cats” (see [HERE](#)) and “Adverse reactions to vaccination” (see [HERE](#)).

CONCLUSIONS

Cat vaccination is a valuable medical procedure and is a corner stone of feline preventive medicine. The transition from the annual cat vaccination with a “one size fits all” approach, to an individual vaccination prescription tailored according to specific needs evaluated during the annual health check visit increases the practitioner’s responsibility and role. Vaccination is obviously far more than “one shot” and requires dedicated time that should be adequately charged.

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