



Feline Health Topics

for veterinarians

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Part II: Hypokalemia in Cats

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Diagnosis of Hypokalemia

In cats with an adequate diet and no history of gastrointestinal disease, urinary loss is the most likely cause of hypokalemia. This can be investigated through urine potassium measurement and determination of fractional excretion of potassium (FE_K). FE_K is determined by measuring creatinine and potassium in both the serum and urine, and applying the following formula:

$$FE_K = \frac{(U_K/S_K)}{(U_{Cr}/S_{Cr})} \times 100$$

(U_K = urine potassium concentration, S_K = serum potassium concentration, U_{Cr} = urine creatinine concentration, S_{Cr} = serum creatinine concentration)

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FE_K values of up to 6 percent are probably normal, although there is disagreement in the veterinary literature.

In all honesty, I have very rarely measured urinary potassium excretion in cats. I have, on occasion, measured it in cats with mild renal dysfunction and normal serum potassium concentrations. In a cat with a normal serum concentration of potassium, but with heavy urinary losses of potassium, I prescribe potassium supplements.

Treatment of Hypokalemia

Treatment of hypokalemia simply involves administration, either enterally or parenterally, of potassium. In non-vomiting patients, oral supplementation with potassium gluconate (1-3 mEq/kg/day) is the best way to treat hypokalemia. There are various formulations available, and most cats seem to tolerate the taste without incident. I recommend potassium supplementation in any cat with a serum potassium concentration of less than 3.5 mEq/L, and supplementation at high levels is probably defensible. As stated earlier, potassium supplementation may result in improved renal function. Although serum potassium concentrations should be monitored in cats chronically treated with potassium gluconate, hyperkalemia due to overzealous supplementation is unlikely to occur.

In vomiting or otherwise critically ill cats, potassium supplementation, in the form of KCl, can be added to intravenous maintenance fluids according to the chart (*see Chart 1*).

Chart 1:

Serum Potassium Concentration

3.5 - 5.5 mEq/L

3.0 - 3.4 mEq/L

2.5 - 2.9 mEq/L

2.0 - 2.4 mEq/L

Less than 2.0 mEq/L

Concentration of Potassium in Fluids

20 mEq/L

30 mEq/L

40 mEq/L

60 mEq/L

80 mEq/L

Remember that lactated Ringer's solution contains 4 mEq/L potassium. Also, make sure that the rate of infusion is not excessive. The patient should not receive more than 1.0 mEq/kg/hour; amounts of KCl added may have to be adjusted in cats on higher fluid infusion rates.

Hypokalemia Due to Post-obstructive Diuresis

Urinary obstruction is a common problem in feline practice, and most feline practitioners are adept at treating this disorder. However, in my opinion, monitoring of serum potassium and proper supplementation is underused. In cases of longer standing obstruction, hyperkalemia can often be severe and can be accompanied by the classical clinical signs of potassium excess. What some clinicians fail to appreciate, however, is the degree to which serum potassium can plummet during the post-obstructive phase. Veterinarians will often choose 0.9% NaCl for intravenous fluid therapy in a hyperkalemic cat after urinary obstruction. This is not sensible. First of all, NaCl is an acidifying solution, and obstructed cats can be acidotic to begin with. Secondly, even though the serum potassium concentration at the time of blockage of the urinary tract can be quite high, it will reliably drop, often precipitously, during the first few hours after urinary catheterization. Severe hypokalemia can develop rapidly, and can be just as life threatening as extreme hyperkalemia. I usually choose lactated Ringer's solution to start with, and I monitor serum potassium every 4 hours and adjust the amount

of potassium in the fluid accordingly.

Selected References:

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Feline Health Topics

A publication for veterinary professionals

The ultimate purpose of the Cornell Feline Health Center is to improve the health of cats everywhere by developing methods to prevent or cure feline diseases, and by providing continuing education to veterinarians and cat owners. All contributions are tax-deductible.

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Client Brochures To Help Explain Vaccine Issues

Dr. James R. Richards, D.V.M.

Vaccination of cats is one of the most volatile issues presently facing the veterinary profession. To state that the paradigm is shifting is hardly an exaggeration; much of what was seen as "truth" in the recent past is no longer viewed as such. For example, when only a few vaccine antigens were available, and when safety was perceived to be so great as to render vaccine administration virtually innocuous, the recommendation that every cat should receive every antigen available every year was clearly justified. But a number of factors now force us to question many of the vaccine dogmas which, for the most part, have served our feline patients fairly well. Questions regarding a vaccine's safety, its ability to protect, and the duration of protection are but a few considerations. Novel vaccine antigens (e.g., *Bordetella bronchiseptica*) and feline vaccines primarily designed to protect people rather than cats (e.g., *Toxoplasma gondii*, *Bartonella henselae*) are being explored as well. More than ever before, it is becoming clear that a "one size fits all" feline vaccination protocol can never be developed. It is neither trivial nor simple to decide what, when, how often, and in what manner a vaccine antigen should be delivered to an individual cat.

Several major national veterinary organizations are in the process of exploring some of these important feline vaccine issues. The American Association of Feline Practitioners (AAFP) and its sister organization, the Academy of Feline Medicine (AFM), have been working since January of this year to develop revised feline vaccination guidelines that will be published later this year. A client education brochure that takes into account these new considerations has been developed by the Cornell Feline Health Center in concert with the AAFP. Designed to assist veterinarians in discussing specific vaccine

issues, the brochure can be given to clients upon their arrival at the clinic. In this way, many vaccine questions can be answered prior to the scheduled vaccination appointment. The text of this brochure, *Feline Vaccines: Benefits and Risks*, can be found in this issue of *Feline Health Topics*.

The Vaccine-Associated Feline Sarcoma Task Force (VAFSTF) recently met to determine which of the study proposals it has received will be awarded financial support (abstracts of the proposals will be published in an upcoming issue of *Feline Health Topics*). The goals and structure of the VAFSTF, along with preliminary vaccine guidelines, can be found in the February 1, 1997 issue of the Journal of the American Veterinary Medical Association and the Task Force's web page at <http://www.avma.org/vafstf/default.htm>. A client brochure, *Vaccines and Sarcomas: A Concern for Cat Owners*, is available from the Cornell Feline Health Center, the American Veterinary Medical Association, and the American Animal Hospital Association. The text of the brochure can be found in this issue of *Feline Health Topics*. An order form is located on page 7 for these and all other Cornell Feline Health Center brochures.



Client Education Brochure

Feline Vaccines: Benefits and Risks

What is the immune system?

Why is it important?

The immune system plays a pivotal role in maintaining your cat's health. One of the most important functions of this highly complex system of specialized cells and molecules is to protect cats from disease and infection caused by foreign invaders: viruses, bacteria, and a host of other microbes and parasites intent on assaulting the body and causing disease.

What does vaccination accomplish?

Vaccines are given to prepare the body's immune system against invasion by a particular disease-causing organism. Vaccines contain antigens which to the immune system "look" like the organism but don't, ideally, cause disease. When the vaccine is introduced by injection or some other means, the immune system responds by mounting a protective response. When the cat is subsequently exposed to the organism, the immune system is prepared and either prevents infection or reduces the severity of disease.

Does my cat need every vaccine available?

No. The choice of which vaccines your cat should receive is dependent on a number of factors including:

- 1) Your cat's risk of exposure to the disease causing organism (in part dependent on the health of other cats to which yours is exposed, and the environment in which your cat lives)
- 2) The consequence of infection
- 3) The risk an infected cat poses to human health (e.g., rabies)
- 4) The protective ability of the vaccine

- 5) The frequency or severity of reactions the vaccine produces
- 6) The age and health status of your cat
- 7) Vaccine reactions your cat may have experienced in the past

Your veterinarian will help guide you in deciding which vaccines are appropriate for your cat. The following vaccines are currently available:

Feline Panleukopenia Virus Vaccine

Feline panleukopenia (also called feline distemper) is a highly contagious and deadly viral disease of cats. Feline panleukopenia virus is extremely hardy, is able to survive extremes of temperature and humidity for many months, and is resistant to most available disinfectants. Until recent years, panleukopenia was the most serious infectious disease of cats, claiming the lives of thousands every year. Thanks to the highly effective vaccines currently available, panleukopenia is now considered to be an uncommon disease. However, because of the serious nature of the disease and the continued presence of virus in the environment, vaccination is highly recommended for all cats.

Feline Calicivirus/Herpesvirus Vaccine

Feline calicivirus and feline herpes virus type I are responsible for 80-90% of infectious feline upper respiratory tract diseases. Most cats are exposed to either or both of these viruses at some time in their lives. Once infected, many cats never completely rid themselves of virus. These "carrier" cats either continuously or intermittently shed the organisms for long periods of time — perhaps for life — and serve as a major source of infection to other cats. The currently available vaccines will minimize the severity of upper respiratory infections, although none will

prevent disease in all situations. Vaccination is highly recommended for all cats.

Rabies Virus Vaccine

Rabies is an increasing threat to cats. At the present time, the number of reported feline rabies cases in the United States far exceeds that of all other domestic animals. Rabies in cats is also a major public health concern. Because of the routinely fatal outcome of infection in cats, and the potential for human exposure, rabies vaccination is highly recommended for all cats; it is required by law in most areas of the country.

Feline Leukemia Virus Vaccine

Feline leukemia virus (FeLV) is the leading viral killer of cats. The virus is spread from cat-to-cat through bite wounds, through casual contact with infected cats, and from an infected mother cat to her kittens. The individuals most at risk of infection are outdoor cats, indoor/outdoor cats, and cats exposed to such individuals. Cats living in households with FeLV-infected cats or with cats of unknown infection status are also at risk. Indoor-only cats with no exposure to potentially infected cats are extremely unlikely to become infected.

FeLV vaccines are recommended for all cats at risk of exposure to the virus.

Chlamydia, Feline Infectious Peritonitis, and Ringworm Vaccines

Vaccines are available for each of these disease-causing organisms, but their use is not routinely recommended for all cats. Your veterinarian will help guide you in deciding whether your cat should receive any of these vaccines.

Why do kittens require a series of vaccinations?

Kittens receive antibody from colostrum (the first milk the mother produces) that is ingested during the early hours after birth. Maternal antibody helps protect against infectious disease until the kitten's

own immune system is more mature.

Unfortunately, maternal antibody also interferes with a vaccine's ability to stimulate the kitten's immune system. To counteract this problem, veterinarians often administer a series of vaccines, usually beginning when the kitten is around six to eight weeks of age, and then repeating vaccination at three or four week intervals until maternal antibody has waned, usually at around twelve weeks of age. In some cases (e.g., rabies vaccines) the initial vaccine is not given until maternal antibody has disappeared.

Does my adult cat need to be vaccinated every year?

The answer depends upon the vaccine. Certain feline rabies vaccines provide protection for longer than one year, so vaccination with a triennially-approved rabies vaccine every three years (after the initial series is completed, and when consistent with local rabies vaccine requirements) is sufficient. Recent research has provided compelling evidence to suggest that panleukopenia/rhinotracheitis/calicivirus vaccines provide adequate protection for several years, so in response, many veterinarians are now recommending that this vaccine be "boosted" at three year intervals as well. Unfortunately, far less is known about the duration of protection provided by other vaccines. Until that information is known, annual vaccination with those products is a reasonable course of action.

Are vaccines dangerous?

Not usually. Unfortunately, a perfect, risk-free vaccine does not exist. Without question, vaccines have saved countless lives, and they continue to be indispensable weapons in the battle against feline infectious disease. But as with any medical procedure, there is a small chance that reactions may develop as a result of vaccination. In most cases, the risks associated with vaccination are much smaller than the risks of disease if vaccines were not given. But to minimize the risk, before your cat is vaccinated,

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Client Education Brochure

Vaccines and Sarcomas: A Concern for Cat Owners

Those of us entrusted with caring for cats have two basic desires: first, we wish to help cats by preventing serious disease and death; second, we wish to do them no harm. Achieving both objectives at the same time seems simple enough. Unfortunately, few medical procedures are totally without risk, and sometimes procedures that are normally helpful can cause harm. The possible association between certain vaccines and sarcomas (specific kinds of cancer) is an example.

Is this something new?

Sarcomas are not new, nor are they extremely rare. But in 1991, veterinarians began to notice a higher than expected number of sarcomas occurring on the body in places where vaccines are commonly injected. Since most sarcomas are not linked with vaccines in any way and those that are associated occur only infrequently it is very difficult to establish a clear relationship. Veterinary scientists are clarifying the picture, but much more needs to be learned.

So what's being done?

Veterinarians are deeply concerned. Even though vaccine-associated sarcomas are uncommon, the problem is receiving unprecedented attention by veterinarians and feline vaccine producers. The Vaccine-Associated Feline Sarcoma Task Force is a coalition of concerned national veterinary organizations dedicated to resolving the dilemma. This group is devoting considerable human and financial resources to determine the true scope of the problem, the exact cause, and the most effective treatment of vaccine-associated sarcomas.

If vaccines are causing problems, why use them at all?

Disturbing as this issue may be, there is great concern that cat owners, attempting to keep their cats from harm, may forego vaccination entirely. The result? Though well-intentioned, these owners may be placing

cats at far greater risk of acquiring a fatal infection than any risk the vaccine poses. And in the case of rabies, human health is at risk as well.

What should I look for?

It is quite common for a small, firm, painless swelling to form under the skin at the site where a vaccine was injected. The swelling is almost always of no consequence, and it usually disappears after several weeks. Rarely, however, the swelling may progress to a sarcoma, so it's important that you contact your veterinarian if you notice a swelling at the vaccine site. In fact, it's wise to contact your veterinarian if you suspect an adverse reaction of any kind after vaccination.

How should I respond?

Until this problem is solved, the best response is to discuss the issue with your veterinarian. In the vast majority of situations, vaccines are much more beneficial than harmful. They continue to do an excellent job of protecting cats from serious infection and disease. But one way to reduce the chance of tumor development is to not vaccinate unnecessarily. Veterinarians are being urged to evaluate each individual cat's risk of infection to guide in deciding which vaccines should be given. After considering both the vaccine and your cat's situation, your veterinarian will assist you in designing a vaccination program that not only protects against infectious disease but is as safe as possible.

Prepared by the Vaccine-Associated Feline Sarcoma Task Force. A combined effort of the AVMA, AAHA, AAFP, and Veterinary Cancer Society, the Task Force consists of representatives from each of the groups, veterinary researchers and clinicians, and representatives from the USDA/APHIS and the Animal Health Institute.

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(continued from page 5)

please inform your veterinarian of any problems your cat is experiencing or any medication your cat is receiving.

Following is a brief list of reactions that may occur after vaccination. If your cat has had any reaction in the past as a result of vaccination, be sure to inform your veterinarian before your cat is vaccinated again.

Mild reactions

■ The following reactions are fairly common, usually start within hours to several days after vaccination, and last no more than several days:

- discomfort at the site where the vaccine was given
- mild fever
- diminished appetite and activity
- sneezing at about four to seven days after administration of an intranasal vaccine

■ Development of a small, firm, non-painful swelling under the skin at the site where the vaccine was given. The swelling usually goes away after several weeks, but if you notice such a swelling, you should contact your veterinarian.

Serious reactions

■ These reactions occur *very rarely*:

- a serious and potentially life-threatening allergic reaction within several minutes to an hour after vaccination
- a kind of tumor called a sarcoma developing at the vaccine site several weeks, months, or even longer following vaccination

What should I do if I think my cat is experiencing a problem as a result of vaccination?

By all means, *consult with your veterinarian*. Even though vaccine-related disease is uncommon, the consequences can be serious. Your veterinarian is the individual most qualified to advise you if an untoward event does occur.

To vaccinate or not to vaccinate?

The decision to vaccinate your cat should be based on a thorough understanding of the benefits — and the risks — of the procedure. For this reason, *it is extremely important that you discuss the procedure with your veterinarian*. He or she will be more than willing to answer any questions you may have, and will help you make the right vaccine choices for your cat.

Prepared by the Cornell Feline Health Center, Cornell University, College of Veterinary Medicine, Ithaca, New York 14853-6401. The ultimate purpose of the center is to improve the health of cats by developing methods to prevent or cure feline diseases and by providing continuing education to veterinarians and cat owners. Much of the work is made possible by the financial support of friends. Copyright 1997 by Cornell University. All rights reserved.



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