

## When Is a Virulent Calicivirus Really a Virulent Calicivirus?

A primer on recognizing the virus—and managing its accomplices and impersonators

BY KATE HURLEY, D.V.M., M.P.V.M.



Virulent systemic feline calicivirus has caused facial edema (abnormal fluid buildup) and ulcers on this kitten's muzzle. MICHAEL BANNASCH/UC DAVIS

A few weeks ago, I woke up to find no fewer than five emails in my in-box containing the same alarming news bulletin: "VIRULENT STRAIN OF CALICIVIRUS FOUND IN CATS IN HUMANE SHELTER." According to these reports, tissue samples from infected cats had tested positive for a mutation of the virus commonly associated with feline upper respiratory infection. Adoptions were shut down at the shelter in question, and pet owners in the community were urged to get their cats vaccinated. The photos were painful to look at: Some of the affected cats had oral ulcers so severe that their tongues were sloughing off.

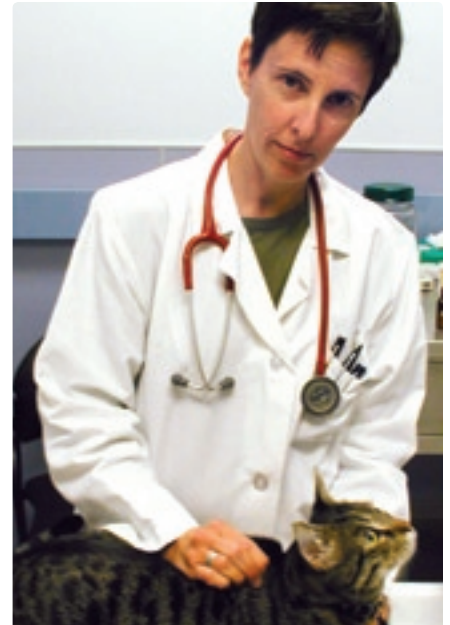
Concerned that virulent systemic feline calicivirus might indeed be the cause, my colleagues and I collected samples from five of the cats who'd been euthanized. What we found was not a surprise

... but neither was it a virulent systemic calicivirus.

Some cats had symptoms suggestive of panleukopenia. Some had severe upper respiratory infection indicating attacks by multiple bacterial and viral pathogens. While calicivirus was present in some cats, no evidence pointed to a virulent systemic type.

The conditions at the facility before the outbreak were all too familiar, a duplication of those that have preceded most of the shelter disease outbreaks I've written about in these pages: The shelter was overcrowded, so cleaning and housing practices were less than ideal. Vaccination was inconsistent, and staff members were overwhelmed.

In this context, we realized that the shelter needed to address multiple causes of disease and correct underlying husbandry problems rather than implement



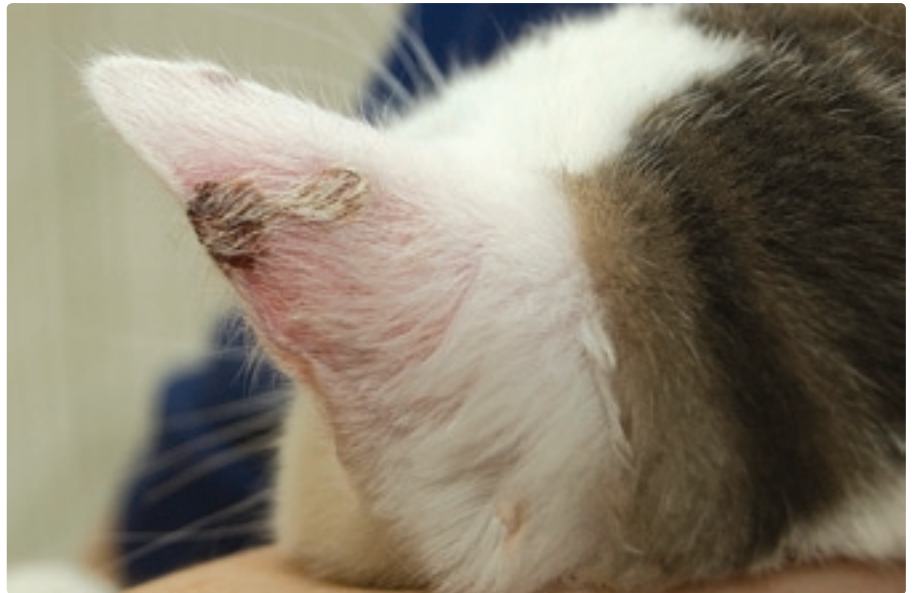
**Kate Hurley**, the director of the **UC Davis Koret Shelter Medicine Program**, has worked in the sheltering field since 1989. Her previous roles included jobs as a kennel attendant, adoption counselor, animal control officer, and shelter veterinarian. She shares this column with Lila Miller, the ASPCA's veterinary adviser and vice president of veterinary outreach.

the drastic measures required to control a true virulent systemic calicivirus outbreak. Feline calicivirus (FCV) is not a straightforward or well-behaved virus. Virulent or otherwise, it's difficult to diagnose, tricky to construct an effective vaccine against, and very challenging to control once it has truly invaded a shelter environment. Long known as a cause of upper respiratory infection, fever, oral ulceration, and lameness in cats, the highly fatal virulent systemic form (VS-FCV) was first identified in the late '90s; a large outbreak was described in "Virulent Systemic Feline Calicivirus: A Case Study," in the May-June 2004 issue of *Animal Sheltering*.

The disease warrants a quick and thorough response when it rears its ugly head, but in this case, it hadn't. Yet in the weeks since that "outbreak," I've gotten at least six calls from other shelters or fos-



Tongue ulcers caused by disinfectant toxicity tend to be horseshoe-shaped (as in photo at right), while those caused by calicivirus can be horseshoe-shaped or may appear as circular lesions of varying sizes (see photo at left). MICHAEL BANNASCH/UC DAVIS



Symptoms of calicivirus and disinfectant toxicosis are strikingly similar; the tabby's ear ulcer is the result of the virus, while the ulcer of the white-eared cat was caused by exposure to a quaternary ammonium product. MICHAEL BANNASCH/UC DAVIS

ter homes panicked because a supposed virulent calicivirus had been diagnosed in one or more of their cats.

Such diagnoses are certainly possible, but some of this increased concern is more likely a result of the publicity surrounding the release of CaliciVax, a new vaccine that includes a strain of virulent calicivirus. While I'm glad to see growing awareness of this potentially problematic virus, I'm

concerned that misdiagnoses could cause needless public panic and lead to drastic shelter measures such as mass euthanasia—when in fact a simple return to good husbandry may be all that's warranted.

Here are some things to keep in mind about calicivirus and its imposters. (For more details, check out my fact sheet at the website of the UC Davis Koret Shelter Medicine Program, [sheltermedicine.com](http://sheltermedicine.com).)

**There is no evidence that virulent systemic feline calicivirus is marching across the United States.** Every documented outbreak of VS-FCV has been limited to a single facility or, at most, a handful of facilities among which animals were transported. All known outbreaks have arisen spontaneously within a shelter, home, or clinic, and have resolved themselves within two to three months.

The bad news is that an outbreak—though rare—could pop up any time, in any community, particularly in an environment where cats are densely housed. But fortunately, an outbreak in a shelter or clinic doesn't indicate greater risk for pet cats or cats sheltered elsewhere in that community—unless cats have been transported directly from an affected facility.

**Infection with calicivirus is common in shelter cats.** Up to a quarter of cats from a shelter background shed calicivirus at any given time, but the infections usually cause no symptoms. Sometimes calicivirus alone can cause upper respiratory infection or lead to other symptoms; sometimes it acts in concert with other viruses or bacteria to trigger more severe illness. The bottom line: Finding calicivirus in a sample from the mouth of a sick cat actually tells you little about the cause of that cat's illness and is *certainly not a cause for panic*. Even isolating FCV from blood or tissue—as was done in the recent outbreak described above—only suggests that the cat is acutely infected with FCV. It does not indicate the strain's potential severity.

**Calicivirus must be judged by its effects on a population.** No simple test exists to distinguish the virulent forms of FCV from more benign strains. The severity of illness in an infected cat depends on both that cat's immune response and the strain itself; we can't look at one infected cat and predict whether the virus will cause severe disease in the next kitty. The infected cat may have an excellent immune system and therefore only mild signs of illness, while another, more vulnerable cat could become severely affected by the same strain.

But you *can* look at the overall pattern in a population to get an idea of the worst symptoms a strain could inflict. If some cats within a shelter develop severe calici-associated systemic or fatal illness, you can assume that even the most mildly affected cats could transmit virus capable of causing severe disease in others. (See sidebar on page 56 for a description of symptoms.) You should use extreme caution when considering placement of cats

potentially infected with such a dangerous strain.

On the other hand, if the virus's effects within a population are limited to run-of-the-mill upper respiratory infections, mild oral ulcerations, or transient limping, the risk of adopting out cats who've recovered is much lower.

**Calicivirus does not always act alone.** Most often, when shelter cats develop severe or fatal disease associated with upper respiratory infection and oral ulceration, we find another bad guy at work as well. I'd estimate that panleukopenia is a significant contributor to nine out of ten of the suspected "virulent systemic feline calicivirus outbreaks" I hear about. Believe it or not, this is good news:

Control of panleukopenia is more straightforward and poses little risk to vaccinated adult pet cats in the community.

Even when oral ulcerations are the predominant symptom, FCV is not always the culprit. Incorrectly diluted disinfectant can cause strikingly similar ulcerations; feline herpesvirus has been known to cause such symptoms, too.

Before tackling the complicated diagnostics for FCV, always consider other causes and rule out easy possibilities first. The most dangerous caliciviruses are those that cause severe disease *without* accomplices like panleukopenia and other pathogens (*Bordetella* often makes an appearance as well)—and without the presence of environmental problems such as poor husbandry and overcrowding. Even

## Infection—or Highly Concentrated Disinfectants?

Incorrectly diluted disinfectants—particularly the quaternary ammonium compounds commonly used in shelters—can lead to problems strikingly similar to symptoms of virulent calicivirus: severe oral ulcers (tongue, palate, and esophagus); scabs and ulcerations of the ear tips and other contact areas; high fever; upper respiratory issues; pneumonia; and even death. (Tongue ulcers caused by disinfectant toxicity tend to be horseshoe-shaped, but those caused by calicivirus can be horseshoe-shaped or may appear as circular lesions of varying sizes.)

When these symptoms appear together, it's prudent to assume an infectious agent is present and isolate animals accordingly. At the same time, it's also important to immediately review disinfection practices. When in doubt, stop using your routine disinfectant and replace with mild detergent and water, followed by correctly diluted bleach or potassium peroxymonosulfate (e.g., Trifectant).

Symptoms stemming from disinfectant toxicity tend to dissipate quickly once the offending chemical is removed; if cats markedly improve within 24 hours, toxicity was the likely culprit. To avoid such a fiasco:

- train a limited number of reliable staff members in proper dilution of the disinfectants to be used by volunteers and less trained animal care technicians;
- clearly post correct dilution ratios and mark all measuring and dispensing devices;
- double-check dilution ratios regularly;
- do not store concentrated disinfectant in animal housing areas, where containers can easily leak or get knocked over and contaminate animals' fur;
- use disinfectants according to manufacturer instructions, and rinse if indicated; and
- use only disinfectants labeled as effective and safe for use in animal care facilities.

asymptomatic cats exposed to a calicivirus capable of causing severe disease by itself must be considered a serious hazard to cats in the larger community, particularly if other well-vaccinated cats in the shelter are severely affected by the strain.

**Vaccination against calicivirus is not always protective.** At best, vaccination decreases the severity of disease. It does

not completely prevent infection or illness. To make life even more difficult, caliciviruses mutate at a higher rate than most viruses, creating a constant risk that some strains will “escape” vaccine protection entirely. Such vaccine-resistant strains have been documented with increasing frequency in the United States.

Fortunately, manufacturers are aware of this problem and are working on vac-

cines that provide broader protection against current FCV strains. Fort Dodge’s recent release of CaliciVax, a vaccine based on the earliest recognized virulent systemic strain of calicivirus, did a good job in the company trials of protecting against illness caused by the same strain it was made from. But unfortunately, the strains that have caused virulent systemic outbreaks in the past have not been closely related to one another. No evidence exists to support the notion that antibodies against one virulent systemic strain of calicivirus are likely to protect against any other strain; in fact, in the cases where testing has been reported, antibodies have not been cross-protective.

While there may be some benefit to vaccinating cats with a second strain of vaccine for general calicivirus protection, the fact that the virulent calicivirus vaccine is “killed”—meaning it contains dead organisms as well as substances designed to enhance the immune-stimulating properties of the vaccine—limits its usefulness in all but a few shelter situations. A modified-live, three-way vaccine that includes herpesvirus, calicivirus, and feline panleukopenia remains the single most important vaccine shelter cats can receive.

**Though virulent systemic feline calicivirus outbreaks remain rare, nonfatal forms of FCV still pose a serious threat to shelter populations.** You can put up the best defenses against outbreaks by:

- minimizing stress and crowding of cats;
- cleaning and disinfecting regularly with a disinfectant proven against un-enveloped viruses (those that lack the fatty “envelope” that makes some viruses vulnerable to common disinfectants)—a disinfectant proven against parvo is the best bet;
- isolating symptomatic animals; and
- vaccinating on intake with a modified-live vaccine.

By decreasing the overall levels of feline infection with calicivirus and reducing the chances that a strain will mutate into a more virulent form, you can help protect the health of cats both in the shelter and in the surrounding community. **AS**

## A Rundown of Symptoms

Use these checklists from sheltermedicine.com to help distinguish between virulent systemic calicivirus and the more benign field strain.

### Clinical conditions sometimes associated with standard infection:

- fever
- ulceration of the oral cavity (including tongue and palate) and nasal planum
- rhinitis
- conjunctivitis
- acute and chronic gingivostomatitis
- acute arthritis/“limping kitten syndrome”
- pneumonia (often with a contributing infection such as *Bordetella*)

### Virulent systemic calicivirus may be present if:

- more than one cat with exposure history has signs consistent with general caliciviral infection (fever, oral ulceration, URI, limping), and those signs preceded the appearance of the symptoms listed below in at least one case;
- signs of vasculitis are present and are not explained by another cause; those signs include facial or limb swelling; extensive crusts/scabs/alopecia; or extensive ulcerations on body, feet, or face/ears (minor scabs on the muzzles or feet are not necessarily cause for alarm, as these may occur with nonsystemic FCV);
- liver damage is described as “individualized hepatocellular necrosis” on a necropsy report;
- some affected cats die; and
- adults are affected more severely than kittens.

### These elements of a cat’s history increase suspicion for VS-FCV infection:

- recent exposure to a multi-cat environment such as an animal shelter, boarding clinic, or veterinary hospital; or recent addition of a new cat to the household;
- clinical signs of typical FCV such as oral ulceration and limping have preceded more severe systemic signs;
- more than one cat is affected (suspicion is decreased if only one cat is affected when many were closely exposed);
- fully vaccinated, otherwise healthy adult cats are affected;
- evidence exists of disease transmission in cats not directly exposed to the suspect case/environment; for instance, cats belonging to clinic or shelter staff are affected, and housemates of cats visiting a vet clinic are exposed (ruling out disinfectant toxicity).