

Toxigenic *Corynebacterium diphtheriae* Infection in a Cat in Texas

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Layda Rincon, an epidemiologist with the Cameron County Public Health Department in Texas. We'll be discussing a case of toxigenic *Corynebacterium diphtheriae* infection in a pet cat.

Welcome, Layda.

[Layda Rincon] Hi, Sarah. Thank you for having me.

[Sarah Gregory] Your article is about a pet cat with toxigenic *Corynebacterium diphtheriae*. First, what is *Corynebacterium diphtheriae*?

[Layda Rincon] *Corynebacterium diphtheriae* is the pathogenic bacterium that causes the disease diphtheria in humans. Diphtheria comes from French, meaning "leather-like", which is making a reference to the thick necrotic respiratory mucous layer that is associated with the disease.

[Sarah Gregory] And explain toxigenicity to us.

[Layda Rincon] Toxigenicity is the bacteria strain's ability to secrete an exotoxin which basically is what causes diphtheria through the necrosis of the upper respiratory system.

[Sarah Gregory] Diphtheria is caused by toxin-producing strains of *C. diphtheriae*, as you just said. But what about non-toxin-producing strains?

[Layda Rincon] The non-toxin-producing strains are not much of a concern since they do not have the gene that produces the exotoxin.

[Sarah Gregory] So they can't make people sick?

[Layda Rincon] No. It's possible, but not really.

[Sarah Gregory] How does *C. diphtheriae* strains become toxigenic?

[Layda Rincon] *C. diphtheriae* can become toxigenic by genetic insertion or it can also occur from bacteriophages, which are basically viruses that can infect the bacteria and make it toxigenic.

[Sarah Gregory] You mention a natural reservoir in your article. What's a natural reservoir? Is it people? Animal? Insects?

[Layda Rincon] So for *C. diphtheriae*, the natural reservoir are humans. They are usually the natural reservoir. There have been some instances of animals, but there are very, very few cases.

[Sarah Gregory] How is it spread?

[Layda Rincon] *C. diphtheriae* is usually spread by respiratory droplets, like people coughing or sneezing. Some people can also get it from touching an infected open wound.

[Sarah Gregory] Many people, I'm sure, out there are familiar with the DTaP vaccine, which helps protect people from diphtheria. With so many adults and children vaccinated with DTaP, are there many cases that still occur in the United States?

[Layda Rincon] No, we actually don't have many cases in the US. Because the immunization practices have been so effective, diphtheria has become quite rare in the States.

[Sarah Gregory] But if someone were to get it, what are the symptoms?

[Layda Rincon] The symptoms are pretty straight forward—it is high fever, sore throat, swollen lymph nodes, difficulty breathing or swallowing. And the most notable symptom is a thick, grey coating that covers the back of the throat, nose and tongue, which makes it hard to breathe and swallow for the patient.

[Sarah Gregory] How is it treated?

[Layda Rincon] Since it's a bacterial infection, it's treated with antibiotics.

[Sarah Gregory] Is it ever fatal?

[Layda Rincon] It can be, but the fatality rate is very low. According to the CDC, it's about 5-10%.

[Sarah Gregory] Last year, EID published an article on *Corynebacterium ulcerans* in hedgehogs. What's the difference between that and *C. diphtheriae*?

[Layda Rincon] So *Corynebacterium ulcerans* is actually mostly common in animals, whereas *C. diphtheriae* is very rarely detected in animals since humans are usually the natural reservoir for it.

[Sarah Gregory] Going back to this cat, has toxigenic *C. diphtheriae* previously been found in any animals?

[Layda Rincon] Yes. Toxigenic *C. diphtheriae* has been found in animals very rarely, but there are a couple of cases where it has been identified in infected animals. However, the toxigenic strain has only been reported and isolated in four other animals, which was one article about a horse in the United States, a horse in Ireland, two dogs in Poland. And our paper is actually the first report of the toxigenic strain of *C. diphtheriae* in a cat.

[Sarah Gregory] So let's talk about your article now. How did you initially find out about this case in this pet cat?

[Layda Rincon] The CDC notified us of a positive culture from a cat that we sent to them from the Texas Veterinary Medical Diagnostic Lab. So we reached out to the cat's owner, asked questions about the cat—whether it was indoor/outdoor, if they had any other pets, if any other pets had similar symptoms, if the owners had any similar symptoms related to diphtheria. And we went on from there.

[Sarah Gregory] And what initially brought the cat to see the vet in the first place?

[Layda Rincon] So according to the cat's owner, the cat had a recurrence of a wound in the flank area. So that's what alarmed them and brought them into the veterinarian.

[Sarah Gregory] Did any of the veterinary staff or the cat's owners or other pets get sick?

[Layda Rincon] No. Thankfully, none of the vet staff or the cat's owners or any other pets got sick. We did collect some samples from the other pets, and they came back negative.

[Sarah Gregory] And what tests were used to detect this infection?

[Layda Rincon] They used oropharyngeal swabs, and those were submitted for culture. And then, in a few days they saw that *C. diphtheriae* is what grew from that culture.

[Sarah Gregory] The isolated bacteria was sent then to the CDC in Atlanta for further analysis. And did they find anything surprising?

[Layda Rincon] No, they didn't find anything unusual other than the *C. diphtheriae* in the cat.

[Sarah Gregory] Did the cat eventually recover?

[Layda Rincon] Yes. Our understanding is that the cat did recover. He was treated with antibiotics which were reported to be susceptible in the culture.

[Sarah Gregory] Okay, this is the burning question to me since this is such a rare event. How did this infection get in this cat in the first place, especially it's my understanding that it's an indoor cat?

[Layda Rincon] Yeah, so we actually don't know the source of the infection. All we know is that...what the cat's owner told us is that in 2014, the cat went missing for a few days and then he came back with some wounds in his back (at that time, he was an outdoor cat). And then in 2017, the owner noticed a mass on his left flank and when they did further testing, they found a chronic mycobacterial infection. And ever since then, the cat has been indoors. So we really don't know what could have occurred and how it might have come back positive for *C. diphtheriae* since no other pets in the household tested positive, nor the owners.

[Sarah Gregory] What are the public health implications of this case study?

[Layda Rincon] Because this case is so groundbreaking as it's the first one to be reported of diphtheria in a cat, there is a lot of lessons to be learned. And how it sets the emphasis on One Health and how our ecosystems are intertwined, there should really be more research and attention given to animals in relation to human beings.

[Sarah Gregory] How can this infection be prevented? There's a vaccine available for people, but what about animals? Is there a vaccine for them, too?

[Layda Rincon] Since *C. diphtheriae* is so rarely detected in animals, there's actually no vaccine for diphtheria in cats or any other animals. There is a disease called calf diphtheria which is caused by a different bacterium, and it's characterized by the presence of pseudomembrane of the respiratory mucosa, but there's no vaccine for that either.

[Sarah Gregory] Layda, tell us about your job and what you like most about it.

[Layda Rincon] Well, I'm an epidemiologist and my job basically consist of performing case investigations on foodborne and waterborne illnesses. I receive labs, I contact the patients, perform the investigations and try to pinpoint what could have made this person sick.

[Sarah Gregory] One final personal question—do you have any pet cats?

[Layda Rincon] No. At this moment, I don't have any pets.

[Sarah Gregory] Well, thank you for taking the time to talk with me today, Layda.

[Layda Rincon] Oh, you're welcome, Sarah. Thank you so much for inviting us and letting people know about this case and this really groundbreaking research we did.

[Sarah Gregory] And thanks for joining me out there. You can read the August 2022 article, Toxigenic *Corynebacterium diphtheriae* Infection in Cat, Texas, USA, online at cdc.gov/eid.

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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