

Shigella sonnei and Shiga toxin

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

[Sarah Gregory] I'm talking with Katherine Lamba today, about her article on *Shigella sonnei* and their previously unknown production of Shiga toxin. Katherine is an infectious disease epidemiologist with the California Department of Public Health.

Welcome Katherine, thanks for talking with me today.

[Katherine Lamba] Thank you, Sarah.

So, tell us about Shiga toxins. What are they?

[Katherine Lamba] Well, Shiga toxins are a group of toxins that can cause human cell damage and cell death. They're typically produced by two types of bacteria, known as Shiga toxin-producing *E. coli* and a specific type of *Shigella* known as *Shigella dysenteriae* serotype 1.

[Sarah Gregory] What effects do Shiga toxins have on a person?

[Katherine Lamba] Shiga toxins can target certain cells in the human gastrointestinal tract, kidney, and central nervous system. This can result in bloody diarrhea, or in some cases, a potentially life-threatening complication known as hemolytic uremic syndrome, which includes destruction of red blood cells and kidney failure. Young children are at highest risk for hemolytic uremic syndrome.

[Sarah Gregory] What's the difference between Shiga Toxins and *Shigella*?

[Katherine Lamba] Shigellae are bacteria that can cause a diarrheal illness in humans. Typical symptoms of *Shigella* infection include diarrhea, which may be bloody and accompanied by fever, nausea, and abdominal cramps. There are four species of *Shigella* bacteria; *Shigella sonnei* is the most common species found in the United States. *Shigella dysenteriae* is more common in developing countries and is the only type of *Shigella* that is usually known to produce Shiga toxin.

[Sarah Gregory] What was unusual about the Shiga toxins you investigated?

[Katherine Lamba] What was unusual was the type of bacteria that were producing the Shiga toxins, rather than the toxins themselves. In the United States, Shiga toxin-producing *E. coli* is the most common bacteria that produces Shiga toxin. In our investigation, we found patients who were infected with *Shigella sonnei* that were producing Shiga toxin. This has rarely been seen before, and has not been previously documented in the United States.

[Sarah Gregory] What were you looking for?

[Katherine Lamba] Well, since this particular strain of *Shigella* was new to California and to the United States, we didn't know where it was coming from, why people were getting infected, or whether the illness it caused would be any different from a typical *Shigella* infection. In our investigation, we wanted to describe the characteristics of the infected patients, and determine if

they had anything in common that would identify the source of their infection. Since Shiga toxins can cause severe gastrointestinal disease, it was important to document the signs and symptoms that infected patients reported, and monitor for any severe outcomes, such as hemolytic uremic syndrome, that are not usually found with a typical *Shigella sonnei* infection.

[Sarah Gregory] And what did you find?

[Katherine Lamba] Well, we monitored for patients with Shiga toxin-producing *Shigella* infections in California from June 2014 through April 2015. During this time period, we found 56 patients from California infected with the strain of *Shigella*. Overall, we found that the patients had a diarrheal illness typical for *Shigella sonnei* infections, and the good news is that no cases of hemolytic uremic syndrome were identified. However, more patients reported having bloody diarrhea than we expected for a *Shigella sonnei* infection. We're not sure yet if this was because of the presence of the Shiga toxin.

We also found that some of the first patients reported a history of travel to Mexico or contact with a sick person who had traveled to Mexico. However, none of the recently identified patients had traveled outside of California. This means that this new strain of *Shigella* was being transmitted within California.

[Sarah Gregory] Should we be worried about this new development? And also, how do these new strains occur?

[Katherine Lamba] We don't know yet whether this new strain will cause more severe disease in people who are infected. People should be aware that it is circulating in California, and has the potential to spread in the United States. Healthcare providers, laboratories, and public health officials should monitor for its spread and any severe outcomes in infected patients.

The genes that code for Shiga toxins are generally carried by bacteriophages, which are viruses that can infect bacteria. These bacteriophages can transfer the Shiga toxin genes back and forth between different types of bacteria, such as between *Shigella* and *E. coli*. This new strain of *Shigella* we found in California could have also been a result of gene transfer from other bacteria. The laboratory investigation is ongoing to determine how Shiga toxin expression became present in these *Shigella sonnei* bacteria in California.

[Sarah Gregory] Are there tests that identify Shiga toxins?

[Katherine Lamba] Yes, there are several different types of laboratory tests that can identify Shiga toxin. These tests need to be performed on a person's feces sample and can be ordered by a healthcare provider. Cultures are needed to figure out which type of bacteria is actually producing the Shiga toxin; whether it was *E. coli* or *Shigella*, for example.

[Sarah Gregory] And how is this kind of infection treated?

[Katherine Lamba] The treatment may depend on which type of bacteria is producing the Shiga toxin. In the United States, Shiga toxins are still most commonly associated with infections due to Shiga toxin-producing *E. coli*. Antibiotics are generally not recommended for the treatment of these types of infections, since studies have shown that it may increase the risk for hemolytic

uremic syndrome. Although antibiotic treatment generally is not essential for *Shigella* infections, patient may be treated with antibiotics since they can reduce the severity and length of illness. However, we don't have enough information to know what the recommended treatment would be for patients infected with Shiga toxin-producing *Shigella sonnei*.

[Sarah Gregory] Are there ways people can protect themselves from getting infected?

[Katherine Lamba] We believe this new strain of *Shigella* is spread the same way that typical *Shigella* bacteria are spread. A person can become infected by consuming food or liquids contaminated by the feces of an infected person. Someone can also become infected by direct or indirect contact with an object contaminated with feces from an infected person. Some examples of how this can occur include: not washing hands properly after changing an infected child's diapers, exposure to the feces of an infected person during sexual contact, or swallowing untreated contaminated recreational water.

To prevent transmission of *Shigella*, people should wash their hands with soap and water carefully and frequently, especially after using the bathroom, after changing diapers, before preparing foods or beverages, and before eating.

[Sarah Gregory] Thank you for talking with me today, Katherine. Katherine Lamba is with me today, discussing her study, Shiga Toxin 1–Producing *Shigella sonnei* Infections, California, United States, 2014–2015. You can read the entire article in the April 2016 issue online at cdc.gov/eid.

I'm Sarah Gregory for Emerging Infectious Diseases.

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