Outbreak of Enteric Adenovirus Associated with a Daycare Facility — Thomas County, May 2019

Background

On May 2, 2019, at 12:00 pm, the Thomas County Health Department (TCHD) notified the Kansas Department of Health and Environment's Infectious Disease Epidemiology and Response section (KDHE) of two attendees of a Thomas County daycare who tested positive for *Campylobacter* spp. antigen by enzyme immune assay (EIA) with one of the two also testing positive for Shiga toxin by EIA. An outbreak investigation was started within an hour to determine the scope of illness, to verify the diagnoses by culture methods and multiplex PCR (mPCR), and to implement prevention and control measures, including exclusion of ill individuals from the daycare until requirements of K.A.R. 28-1-6 were met.

Key Investigation Findings

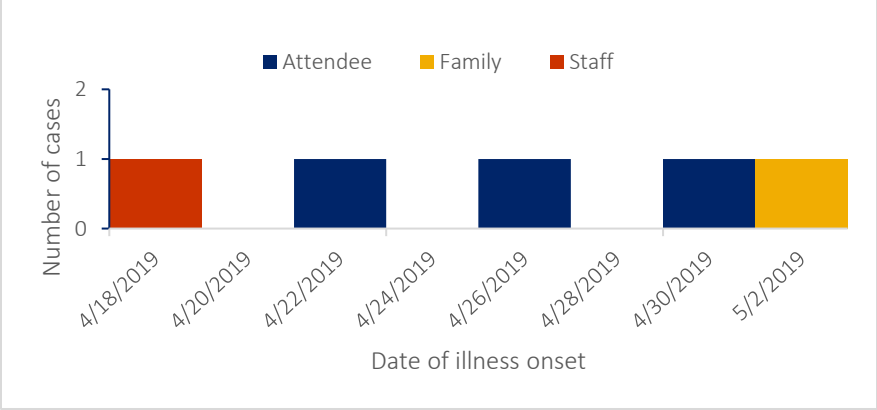
- A case was defined as diarrhea occurring between April 18 to May 2, 2019, in an attendee or staff member of the Thomas County daycare or in a household member of an attendee with diarrhea.
- Four individuals in the daycare and one parent of an attendee experienced diarrheal illness between April 18 to May 2, 2019; this included three attendees and one daycare worker.
- The most frequently reported symptoms were diarrhea and vomiting (Table 1).

Table 1: Clinical Symptoms Reported Among Ill Persons (N=5)

Symptoms	***# of Ill Persons/Total***	***% of Ill Persons***
Diarrhea	5/5	100.0%
Vomiting	3/4	75.0%
Nausea	2/3	66.7%
Abdominal Cramps	2/3	66.7%
Fever	1/4	25.5%
Blood in Stool	1/5	20.0%

- Ages of case-patients ranged from 1-30 years (median = 2 years).
- Of the five case-patients, three (60%) were female.
- Onset dates were available for all case-patients. Onset of illness ranged from April 18 to May 2, 2019. (Figure 1)

Figure 1: Number of cases of diarrhea by onset date and daycare association, April-May 2019 (n=5)



- A daycare worker did experience symptom onset while working at the daycare.
- The incubation period was calculated for the daycare attendee with the earliest onset whose exposure was the symptomatic daycare worker, and for the parent exposed to a symptomatic child in the home. The incubation for both individuals was four days.

- Recovery dates were available for four case-patients. The duration of illness ranged from one to eleven days, with a median of four days.
- No case-patients were hospitalized. The daycare worker did visit an emergency room, but no stool specimen was collected for testing; four other case-patients were treated by a medical provider who did collect and test stool specimens. (Table 2)
- The TCHD submitted a stool specimen for the daycare worker who had not been tested and made attempts to have specimens for all patients forwarded to the Kansas Health and Environmental Laboratory (KHEL) for testing. Stool specimens were collected and tested for all case-patients; three patients had testing performed at KHEL. (Table 2)
- The attendee who tested positive for Shiga toxin submitted two additional stool specimens to TCHD to lift an exclusion from daycare for an attendee with a case of Shiga toxin-producing *Escherichia coli* (STEC). (Table 3)
- Further testing of stool specimens at the KHEL state laboratory could not confirm the *Campylobacter* antigen-positive results by culture and could not confirm that STEC was present by multiplex nucleic acid testing (mPCR). (Table3)
- Two case-patients' stools tested by mPCR were positive for Adenovirus F 40/41 with one was also positive for astrovirus.

Table 2: Commercial Laboratory Test Results Reported Among Ill Persons (N=5)

	Onset	***Collection Date***	***Test Date***	***Campy EIA***	***Shiga Toxin EIA***
Patient 1 (Staff)	04/18/2019				
Patient 2 (Child)	04/22/2019	05/01/2019	05/01/2019	Positive	Negative
Patient 3 (Child)	04/25/2019	04/30/2019	05/01/2019	Positive	Positive
Patient 4 (Child) [1]	04/29/2019	05/01/2019	05/02/2019	Negative	Negative
Patient 5 (Parent) [1]	05/02/2019	05/02/2019	05/02/2019	Negative	Negative

Table 3: KHEL Laboratory Test Results Reported Among Ill Persons (N=3)

	Onset	***Collection Date***	***Test Date***	***Multiplex PCR*** [2,3]	***Campy Culture***
Patient 1 (Staff)	04/18/19	05/07/19	05/09/19	Adenovirus +	Negative
Patient 2 (Child)	04/22/19	05/01/19	05/06/19		Negative
Patient 3 (Child)	04/25/19	04/30/19	05/08/19		Negative
Patient 3 (Child)	04/25/19	05/04/19	05/08/19	Adenovirus +; Astrovirus +	
Patient 3 (Child)	04/25/19	05/06/19	05/08/19	Adenovirus +; Astrovirus +	

[1] *Specimens for patient 4 and patient 5 were not sent to KHEL.*

[2] *Specimens received >4 days from collection were not suitable for multiplex PCR testing.*

[3] *Multiplex PCR testing was an enteric screen that included targets to: Campylobacter, Clostridium difficile toxin AB, Plesiomonas shigelloides, Salmonella, Vibrio, Vibrio cholerae, Yersinia enterocolitica, Enteroaggregative E. coli, Enteropathogenic E. coli, Enterotoxigenic E. coli lt/st, Shiga toxin E. coli, E. coli 0157, Shigella Enteroinvasive E.coli, Cryptosporidium, Cyclospora cayetansis, Entamoeba histolytica, Giardia lamblia, Adenoviurs F 40/41, Astrovirus, and Norovirus GI/II.*

Conclusions and Recommendations

This was an outbreak of gastrointestinal illness associated to a daycare in Thomas County that was most likely the result of adenovirus species F 40 or 41. Five persons with outbreak cases of diarrheal illness had onsets between April 18 to May 2, 2019 and had association to the daycare environment or an ill person from the daycare prior to onset of symptoms. Two case-patient's stool specimens were analyzed via multiplex PCR and were determined to be positive for adenovirus F 40/41; astrovirus detected in one case-patient's stool was not detected in the second patient's specimen. The initial report of campylobacter and Shiga toxin antigen detected by immunoassay could not be confirmed at KHEL. The incubation period for two cases was four days and the recovery period for four cases ranged from one to 11 days with a median of four days.

Adenovirus species F 40 and 41 represents two specific strains of a non-enveloped, enteric adenovirus that cause gastroenteritis. [1] These enteric adenoviruses are a common cause of acute gastroenteritis worldwide and the third most common cause of gastroenteritis in infants after rotavirus and norovirus. [2] Infections can occur at any time of the year and primarily occur among children younger than 4-years old. The incubation period of enteric adenovirus infections is approximately 3 to 10 days. [1] Symptoms are characterized by onset of persistent diarrhea which may later be accompanied by fever and mild vomiting. Adenovirus type 40 infections generally have a more intense onset of diarrhea which may persist for 9 days; adenovirus type 41 infections have a mean duration of diarrhea of 12 days with prolonged symptoms sometimes occurring. [1,3]

The enteric adenovirus is transmitted by the fecal-oral route. Individuals can be asymptomatic and still shed the virus in their feces, but infections are most communicable during the early days of an acute illness.[1] In disease outbreaks, viral transmission can occur via contaminated surfaces. Contamination of surfaces can originate from the transfer of vomit and fecal matter to hands and surfaces and the aerosolization of virus from the flushing of a toilet allowing the virus to contaminate surfaces of a bathroom. [4] The virus can survive persist for 7 days to 3 months on dry inanimate surfaces and can be easily spread to the mouth when fomites and hands are contaminated. [2] The risk of transmission is higher with small children as there is documentation that finger to mouth contact occurs every 3 minutes or a hand-to-mouth frequency of 9.5 contacts per hour. [4]

The presence of an infected individual at the daycare at the time of symptom onset provided a potential source of contamination of the daycare environment and subsequent infection for the young children present. The outbreak investigation was aided by the quick response of TCHD

and its cooperation with the local hospital. KDHE assisted TCHD by providing testing services through KHEL, resulting in the identification of a previously undetected cause of illness and evidence to support the potentially false-positive EIA results. The possibility of false-positive EIA results and the importance of EIA confirmation by additional methods has been documented in previous investigations and studies. [5,6]

The proper exclusion of ill individuals from the daycare and with increased cleaning of environmental services helped to limit the spread of the outbreak. To assist with education, a fact sheet was prepared by KDHE for TCHD to provide to the facility and parents. Because individuals can remain asymptomatic but still carry the virus in their stool, as shown by the daycare worker who had been asymptomatic for 12 days prior to testing positive for adenovirus, ongoing vigilance in handwashing and cleaning of environmental services at the facility was stressed.

Attachments:

- Enteric Adenovirus Fact Sheet

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Adenovirus Type 40/41 Fact Sheet

What are adenoviruses?
Adenoviruses are common viruses that cause a wide range of illness. There are at least 52 immunologically distinct types that can cause human infections. Enteric adenovirus types 40 and 41, cause gastroenteritis, usually in children.

How common are enteric adenoviruses?
Enteric adenoviruses are a common cause of acute gastroenteritis worldwide. They are the third most common cause of infantile gastroenteritis after rotavirus and norovirus. Infections can occur at any time of the year and primarily among children younger than four years old.

How is enteric adenovirus spread?
The virus is transmitted by the fecal oral route. Children can be asymptomatic and still shed the virus in their feces.

How long after being exposed to an adenovirus before symptoms start?
The incubation period of enteric adenovirus infections is approximately 3 to 10 days.

What are the symptoms of enteric adenovirus?
Usually, a mild case of gastroenteritis characterized by persistent diarrhea accompanied by a fever and vomiting of short duration.

With Adenovirus type 41 infections, the mean duration of diarrhea is 12 days, but prolonged symptoms may occur. An adenovirus type 40 infection generally has a more intense onset with diarrhea lasting around 9 days.

With both serotypes, vomiting is mild, beginning 1.5 days after diarrhea onset, and ceases after 2 days. Fevers also are mild with a short duration of 2-3 days and only moderately-high temperatures.

How serious is an enteric adenovirus infection?
Adenovirus gastroenteritis is not a very serious disease as it rarely causes significant dehydration requiring parenteral or oral rehydration therapy. However, the diarrhea caused by Adenovirus 41 can persist and threaten the survival of anyone who has malnutrition.

How is enteric Adenovirus treated?
There is no vaccine available for enteric adenoviruses, nor is there a good treatment besides rehydration therapies.

How can I avoid spreading infection to the rest of my household?
Practices good personal hygiene. This includes thorough hand washing with soap and water after using the toilet, after changing diapers, and before handling food.

Adenoviruses are very stable in the environment and persist for 7 days to 3 months on dry inanimate surfaces, but they can be inactivated by contact with 1:5 dilution of bleach for 1-2 minutes, and by contact with alcohol-based hand gels.

Sources:
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