# Enterohemorrhagic *Escherichia coli* O157:H7: case report

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**Enterohemorrhagic *Escherichia coli* (EHEC) is a significant bacterial pathogen of bloody diarrhea. Not only does it cause systemic complications, such as hemolytic uremic syndrome (HUS) (the most common cause of potentially preventable pediatric renal failure), but it also leads to large outbreaks of bloody diarrhea. Among EHEC serotypes that cause HUS, *E. coli* O157:H7 is the most common. Herein, we present the case of a young girl with *E. coli* O157:H7 infection and review the related literature.**

***Key words: enterohemorrhagic Escherichia coli (EHEC), verotoxin-producing Escherichia coli (VTEC), Shiga-toxin-producing E. coli (STEC), E. coli O157:H7, hemolytic uremic syndrome (HUS).***

Enterohemorrhagic *Escherichia coli* (EHEC) belongs to a pathogenic subgroup of shiga toxins that produce *E. coli*. These bacteria are sometimes called verotoxin-producing *E. coli* (VTEC) or Shiga-toxin-producing *E. coli* (STEC). Since first described in 1982, EHEC has become known as a major infectious cause of bloody diarrhea. Most cases are sporadic or occur in small clusters. Hemolytic uremic syndrome (HUS) is the most worrisome complication of EHEC infections and is characterized by the triad of acute renal failure, microangiopathic hemolytic anemia, and thrombocytopenia, with a fatality rate between 2% and 7%. Antibiotics and antimotility agents should not be given to patients with definite or possible EHEC infections owing to the increased risk of developing HUS[1-4]. In Turkey, laboratory-based surveillance systems that identify EHEC infections have been included in the national Communicable Disease Surveillance and Notification System since 2005[5]. It is important that all clinicians be aware of EHEC infections owing to their potential for life-threatening complications and because of the epidemiological significance. Herein, we present the case of a young girl with *E. coli* O157:H7 infection and review the relevant literature.

## Case Report

A seven-year-old girl on vacation with her family presented at our institution with a four-day history of diarrhea, abdominal pain, and nausea. On the first day, she had watery diarrhea, whereas two days later the diarrhea became grossly bloody. Her mother also had nonbloody diarrhea. The girl's body temperature was normal. On palpation, the abdomen was soft but diffusely tender with hyperactive bowel sounds. Microscopic investigation of the stool revealed leukocytes and erythrocytes. The initial diagnosis was infectious colitis. After taking a stool culture, empiric antibiotic treatment (metronidazole and trimethoprim-sulfamethoxazole) was started. Stool culture plates on sorbitol-MacConkey agar revealed sorbitol-negative colonies with biochemical properties of *E. coli*. Strains presumptively identified as *E. coli* O157:H7 were sent to the Turkish National Enteric Pathogens Reference Laboratory for further analysis. The patient's doctor was given information about EHEC infection, and the initial antimicrobial treatment was stopped. In the reference laboratory, the sorbitol-negative colonies were serotyped by agglutination test using *E. coli* O and H antisera set (Deinka Seiken, Tokyo, Japan), and

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verotoxin production was determined by the Vero cell assay. Verotoxin typing was done using a VTEC-RPLA verotoxin detection kit (Oxoid, Hampshire, England). Verotoxin 2 (vt 2) was positive, but verotoxin 1 (vt 1) was negative. We queried the hotel where the patient was staying regarding the source of infection, but our request was not acknowledged; the hotel closed a short time later. Several days after this, the patient flew home with her family. In a telephone call one month later, the patient's parents conveyed that she had recovered from the illness without complication.

## Discussion

The annual incidence of EHEC infections ranges from 0.1 to 12 cases per 100,000 population. *E. coli* O157:H7 is the most common cause of HUS in most of the world[4]. In Turkey, the true incidence of EHEC infections is not known. Cases are likely to be underdiagnosed owing not only to improper laboratory diagnostic methods but also to a lack of awareness of the epidemiologic significance. Individual case reports and a few small case series of persons traveling to Turkey have been reported by foreign authors[6-8]. Several researchers have cited the incidence of *E. coli* O157:H7 in humans in Turkey as varying from 0% to 4%[9-13], but only one of these studies was accompanied by verotoxin detection (Table I). According to data from the Ministry of Health, National Communicable Disease Surveillance and Notification System, total numbers of notified EHEC strains were 21 in 2005 and 46 in 2006.

Enterohemorrhagic *E. coli* is a foodborne pathogen. The main reservoir for *E. coli* O157:H7 is cattle and other ruminants. Several studies in different countries have shown that 10%-80% of cattle may carry the VTEC[14]. In Turkey, little data are available regarding the presence of *E. coli* O157 in cattle and other ruminants. Aslantas and colleagues[15] reported that *E. coli* O157 was isolated in 77 of 565 clinically healthy cattle samples (13.6%) in the Hatay province. Of those 77 isolates, 66 were serotype O157:H7, and polymerase chain reaction (PCR) analysis revealed that 62 were positive for vt2, and 3 were positive for both vt1 and vt2. Of 5 abattoirs in Istanbul, Yılmaz and colleagues[16] reported isolating 27 strains of *E. coli* O157:H7 and 5 strains of *E. coli* O157 from cattle, cattle carcasses, and environmental samples. In DNA samples extracted from the 27 strains of *E. coli* O157:H7, 24 were positive for vt2, and 5 were positive for vt1 and vt2. According to these studies, Turkish cattle are a significant reservoir for *E. coli* O157 and can potentially cause serious disease in humans.

The three principal routes of transmission of *E. coli* O157:H7 are contaminated consumables, person-to-person spread, and animal contact. The infectious dose for this pathogen is estimated at well under 100 organisms. Contaminated meat and unpasteurized milk are the major routes by which these pathogens enter the food chain. A wide range of other food products has been implicated in outbreaks of EHEC infections, including cheese, yogurt, fermented sausages, apple juice, seed sprouts, and lettuce[1,17]. In our patient, we were unable to identify the source and mode of transmission because detailed epidemiologic investigations were not performed.

Enterohemorrhagic *E. coli* strains possess at least two virulence factors: an adherence mechanism and two verotoxins that are responsible for vascular damage (hemorrhagic colitis) and for the systemic effects. Clinical manifestation of *E. coli* O157:H7 infection is characteristic. After a typical incubation of

**Table I.** Prevalence of Enterohemorrhagic *Escherichia coli* Infections in Patients with Diarrhea and Bloody Diarrhea in Turkey

| Study | Age group | Number of stool samples | Number of isolates of *E. coli* O157:H7 n (%) | Verotoxin detection |
|---|---|---|---|---|
| Yıldız et al.[9] | Child | 150 | 6 (4%) | Not tested |
| Kaleli et al.[10] | Adult and child | 681 | 1 (0.1%) | Not tested |
| Tolun et al.[11] | Unknown | 511 | 2 (0.004%) | 9 (0.01%) |
| Aydoğan et al.[12] | Adult and child | 100 | 3 (3%) | Negative |
| Hasçelik et al.[13] | Child | 677 | 0 | 0 |

three to four days, patients develop watery diarrhea accompanied by abdominal cramping pain lasting one to three days. During the next several days, watery diarrhea changes to bloody diarrhea in about 90% of culture-confirmed patients[1]. As in our patient, absence of fever on initial examination, presence of grossly bloody stools, and the overall severity of abdominal findings should prompt clinicians to consider EHEC infection.

The United States Centers for Disease Control has recommended that *E. coli* 0157:H7 be considered in all persons with acute bloody diarrhea or HUS. Unlike many other fecal isolates of *E. coli*, *E. coli* O157:H7 ferments sorbitol slowly or not at all, and this allows screening for this serotype in stool on sorbitol-MacConkey agar. The ideal detection method for *E. coli* O157:H7 is culture of the stool on sorbitol-MacConkey agar accompanied by a verotoxin detection assay[1-3]. In our patient, sorbitol nonfermenting *E. coli* O157:H7 was isolated from stool, and this isolate was cytotoxic for Vero cells and possessed the vt2; thus, the laboratory diagnosis could be precisely made.

Hemolytic uremic syndrome develops in approximately 15% of patients younger than 10 years of age diagnosed with *E. coli* O157: H7 infection and occurs 5 to 13 days after the onset of diarrhea. Some risk factors, including an elevated white blood cell count, early presentation for care, antibiotic administration, use of antimotility agents, and age younger than 10 years, are associated with increased risk of developing HUS[17]. There is no specific therapy for EHEC infections, although antibiotics, antimotility agents, opioids, and nonsteroidal anti-inflammatory drugs should not be given to acutely infected patients. The only current treatment of EHEC infection is supportive, with monitoring for the development of microangiopathic complications. Patients seem to benefit from early hospitalization and intravenous fluid administration during the diarrheal phase[1,17]. In our patient, antibiotics that were begun empirically were stopped, and the patient was observed as an outpatient. The patient returned to her own country within a few days. One month later, in a telephone call, the patient's parents conveyed that she had recovered from the illness without complications.

Prevention of EHEC infection requires a reduction in fecal soilage of meat during slaughter and processing. Proper cooking of foods is also important, and cooking meat to an internal temperature in excess of 68.3°C is necessary to eradicate EHEC contamination. Improved identification of patients with EHEC infection and better collaboration may lead to earlier recognition of outbreaks[4,14]. After one publication had reported international clusters of *E. coli* O157 infections that had originated in southwest Turkey[6], we added sorbitol-MacConkey agar in our routine stool cultures and our case was thus detected.

In conclusion, diagnosis of EHEC infection calls for a high degree of suspicion and constant vigilance. In daily practice, screening for the *E. coli* O157:H7 intestinal pathogen is not routinely performed in most laboratories in Turkey. When EHEC infections are suspected, the laboratory must be alerted to culture stool specimens for *E. coli* O157:H7 on sorbitol-MacConkey agar and to detect verotoxin. As in our patient, the reference laboratory can be approached for technical support and for the exact diagnosis of suspected cases. Further studies are required to determine the true incidence of diarrhea or bloody diarrhea associated with EHEC infections in Turkey.

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