



Review

Non-O157 Shiga toxin-producing *Escherichia coli*—A poorly appreciated enteric pathogen: Systematic reviewEvangelia Valilis^a, Alison Ramsey^{a,b}, Saad Sidiq^b, Herbert L. DuPont^{a,b,c,d,*}^a University of Texas McGovern School of Medicine, Houston, TX, USA^b University of Houston, Houston, TX, USA^c University of Texas School of Public Health, Houston, TX, USA^d Baylor College of Medicine, Houston, TX, USA

ARTICLE INFO

Article history:

Received 16 July 2018

Received in revised form 4 September 2018

Accepted 5 September 2018

Corresponding Editor: Eskild Petersen, Aarhus, Denmark

Keywords:

Shigatoxin producing *E. coli*
hemolytic uremic syndrome
dysentery

ABSTRACT

Non-O157 strains of Shiga toxin-producing *Escherichia coli* (STEC) are more common causes of acute diarrhea than the better-known O157 strains and have the potential for large outbreaks. This systematic review of the literature identified 129 serogroups as well as 262 different O and H antigen combinations of STEC in cases of epidemic and sporadic disease worldwide. Excluding the results from a single large outbreak of STEC O104:H4 in Germany and France in 2011, the reported frequency of dysenteric illness in patients was 26% (119 of 464) for epidemic disease and 25% (646 of 2588) for sporadic cases. Hemolytic uremic syndrome was identified in 14% of epidemic disease cases and 9% of sporadic illness cases. With the increasing use of PCR-based diagnostics, STEC strain identification may not be possible. Rapid diagnostics are needed for STEC infections to aid the clinician while allowing epidemiologists the opportunity to identify outbreaks and to trace the source of infection.

© 2018 Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Contents

Introduction	82
Methods	83
Results	83
Epidemic disease reportedly due to non-O157 strains of STEC	83
Sporadic disease reportedly caused by non-O157 strains of STEC	84
Surveillance of non-O157 STEC strains in the USA 2002–2014	84
Number of non-O157 STEC serogroups	84
World regions where STEC infections occur	84
Acute dysentery caused by STEC strains: non-O157 versus O157	84
Rates of HUS complicating enteric infection due to non-O157 versus O157 STEC strains	85
Sources of non-O157 STEC outbreaks	85
Diagnostic challenges in STEC infection	85
Discussion and conclusions	85
Key points	86
Funding source	86
Ethical approval	86
Conflict of interest	86
References	86

Introduction

Shiga toxin-producing *Escherichia coli* (STEC), also known as verocytotoxigenic *E. coli* (VTEC) and enterohemorrhagic *E. coli* (EHEC), is a unique pathotype of *E. coli* that produces a Shiga toxin,

* Corresponding author at: 1200 Herman Pressler, Suite 733, Houston, TX 77030, USA.

E-mail address: Herbert.L.Dupont@uth.tmc.edu (H.L. DuPont).

which is related molecularly to the toxin expressed by *Shigella dysenteriae* type 1 (the Shiga bacillus). The most common illness produced by STEC strains is hemorrhagic colitis.

STEC first emerged as a cause of foodborne illness in 1982 when a multi-state outbreak of illness occurred as a result of serotype O157:H7 contaminating hamburgers. Laboratory methods for detection are readily available, and since becoming reportable in 1995, O157 strains have become established as causes of outbreaks and sporadic symptomatic and asymptomatic infections worldwide, in many cases associated with the passage of bloody stools (dysentery). First documented in the USA in 1994, non-O157 STEC strains have grown in importance as a cause of illness, peaking with a unique and well-publicized outbreak of a strain of STEC O104:H4 in northern Germany in May and June 2011.

Estimates from the US Centers for Disease Control and Prevention (CDC) indicate that although largely undetected, non-O157 STEC strains as a group outnumber O157 strains as causes of human illness (Hadler et al., 2011; Hale et al., 2012).

This review of the literature was performed to determine the importance of non-O157 STEC as a cause of diarrhea in humans, and to compare the rates of dysentery and hemolytic uremic syndrome (HUS) in infections caused by non-O157 strains of STEC with those seen in infections caused by O157 strains. In reporting the percentages of these, this is the number with either dysentery or HUS divided by the number analyzed for that specific condition $\times 100$.

This review is timely since no review of the global importance of non-O157 STEC illness has been published since 2006 (Johnson et al., 2006), specific rates of dysenteric disease or the frequency of developing HUS in infections caused by specific serogroups and serotypes of non-O157 STEC (Bettelheim, 2007) have not been published, and non-O157 strains of STEC continue to be ignored as etiological agents in non-outbreak diarrhea (Clogher et al., 2012). Furthermore, with the increasing use of nucleic acid identification of STEC infections, we are concerned that epidemiology of these infections needed for the institution of prompt control measures will not be possible.

Methods

A search of the PubMed database for relevant articles on “non-O157 Shiga toxin-producing *Escherichia coli*” was performed on

June 20, 2017, and the titles of articles identified were reviewed. The search included O157; shiga-toxigenic *Escherichia coli*; *Escherichia coli*; toxigenic *Escherichia coli*. This search retrieved articles on STEC, VTEC, and EHEC cases. In order to obtain all significant articles not covered in the initial search, an additional search was performed for each of the top six serogroups by including each serogroup with the term “Shiga Toxin Producing *Escherichia coli* Outbreak”.

The abstracts of all titles of interest and the full texts were reviewed if the publications dealt with STEC epidemiology, etiology, the clinical features of diarrhea, or the development of dysenteric diarrhea and hemolytic uremic syndrome (HUS). Special attention was made to eliminate studies reporting the same patients in multiple studies.

The literature was reviewed to provide data on non-O157 strains of STEC as causes of well-defined outbreaks involving two or more cases, or as causes of sporadic disease in populations not involved with a known outbreak. For analysis, the studies were divided into two groups: well-defined outbreaks versus isolated cases of apparently non-epidemic disease. Whenever possible, complete typing of strains was included if this was reported in the papers in terms of the flagellar (H) and somatic (O) antigens, in order to determine any differences between strains of STEC. Disease caused by non-O157 serotypes became nationally notifiable in the USA in 2000, and it was observed that more outbreaks around the world were reported in the literature after that year.

Additionally, the annual reports compiled by the CDC – National Surveillance of Bacterial Foodborne Illness (Enteric Disease) and National Shiga Toxin-Producing *Escherichia coli* (STEC) 2002–2014–were reviewed.

Results

The following sections deal with outbreaks and sporadic cases of non-O157 STEC on a global basis, looking at clinical and epidemiological features.

Epidemic disease reportedly due to non-O157 strains of STEC

The reported outbreaks are summarized chronologically in Table 1. In this table, the outbreaks begin in 1995 when these strains were first identified and end with the most recent 2017 outbreaks. A total of 674 outbreaks worldwide caused by non-O157

Table 1

A description of the global reports of outbreaks of two cases or more of non-O157 strains of Shiga toxin-producing *Escherichia coli* along with the reported frequency of dysentery and hemolytic uremic syndrome where these data were available, and the implicated vehicle of transmission, 1995–2017.

Years	Number of confirmed cases	Median number of people per outbreak (range)	Serogroups/types	Number reporting dysentery (%)	Number reporting HUS (%)	Implicated vehicle of transmission
1995–1999	183	25/(2–131)	O26:H11, O111:(H-,H8), O118:H2	6/57 (11%)	16/183 (8.7%)	Ice in open barrels, serving utensil, dry fermented sausage
2000–2004	26	11/(2–13)	O26:H11, O148:H8	0/26 (0%)	2/26 (7.7%)	Mutton, beef
2005–2009	221	16/(3–156)	O26:(H11), O45, O103: H25, O104:H4, O111, O145: H28	93/137 (68%)	34/91 (37%)	Ice cream, farm animals, eating outside of home, restaurant, beef sausage, mutton
2010–2014	184	25/(2–35)	O26:(H11), O103:H2, O104:H4, O111:H8, O121, O145:(NM)	20/184 (11%)	26/184 (14%)	Raw clover sprouts, Farm Rich brand frozen products, dairy products, cattle, person-to-person, venison, romaine lettuce
	3816	3816	O104:H4 ^a	141/161 (88%)	845/3816 (22%)	Sprouts
2015–2017	60	30/(5–55)	O26	0/60 (0%)	0/60 (0%)	Multiple restaurant chains
Total minus STEC O104:H4 ^a	674			119/464 (26%)	78/544 (14%)	

HUS, hemolytic uremic syndrome; STEC, Shiga toxin-producing *Escherichia coli*.

^a Outbreak in Germany and France in 2011.

Download English Version:

<https://daneshyari.com/en/article/11025434>

Download Persian Version:

<https://daneshyari.com/article/11025434>

[Daneshyari.com](https://daneshyari.com)