

## SHORT REPORT

Daily bowel movements and *Escherichia coli* O157 infection

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The usual bowel habits of 259 school age children before the large outbreak of *E coli* O157 infection in Sakai City in the summer of 1996 were investigated. A daily morning movement and/or frequent bowel movements may be a protective factor against infection, while being constipated contributed to a worsening of symptoms.

Since 1982, infections caused by *Escherichia coli* O157:H7 have emerged as a major public health concern in developed countries.<sup>1</sup> The condition is often associated with haemolytic uraemic syndrome and may lead to death. The reasons for such serious complications remain unknown. One report of the 1996 Sakai outbreak of *E coli* O157 infection involved 8938 schoolchildren; 82% had diarrhoea, 72% abdominal cramps, and 27% bloody stools. *E coli* O157 was isolated from the stools of 2311 (25.9%) children, and 614 (6.9%) schoolchildren were hospitalised. A total of 107 (1.2%) inpatients were diagnosed with haemolytic-uraemic syndrome (HUS); three girls died.<sup>2</sup>

A telephone survey of 14 children of friends who lived in Sakai just after the outbreak showed that half had only mild symptoms. These children had two or more bowel movements a day when well. By contrast, three of five children admitted to our hospital with haemolytic-uraemic syndrome had a history of constipation. The most severely affected child, who later died, had not had a bowel movement for three or four days. To test the hypothesis that the bacteria could survive and grow in the intestines of children when retained for longer periods, we examined their daily bowel habits before the onset of infection as an indicator of the time the bacteria could be retained.

## PATIENTS AND METHODS

In March 1998, we conducted a mailed questionnaire survey of 587 school age children who presented to our centre. The questions were: (1) How many times a day did you usually have bowel movements before the outbreak in summer, 1996? (2) When during the day do you empty your bowels? (3) Do you empty your bowels just after meals? (4) How long does it take you to empty your bowels?

The social class and family size of the subjects were similar, as the two main districts studied were new suburban areas for young to middle aged workers of central Osaka.

Statistical analyses were performed by  $\chi^2$  tests and logistic regression analyses using the SAS program.

## RESULTS

There were 259 responses (44%) from 139 boys, 118 girls, and two of unknown gender. The answers were provided by their mothers. *E coli* O157 was cultured from the stools of 65 (25.1%) of the children. The isolation rate among the study subjects was similar to that (25.9%) of the total number infected.<sup>2</sup> The severity of illness could be classified into three

groups: A, bloody diarrhoea and abdominal pain; B, abdominal pain and diarrhoea without bloody stool; and C, no symptoms. Groups A/B/C constituted 89/109/61 of the total population, and 25/24/16 among children with a positive stool culture. The age distribution of the subjects was: 6 years, n = 30; 7 years, n = 56; 8 years, n = 39; 9 years, n = 46; 10 years, n = 38; 11 years, n = 48; unknown, n = 2.

The ages, distribution among schools, and severity of symptoms for the respondents were not significantly different from the non-respondents. No family took special measures to alter bowel habits.

Table 1 shows the daily bowel movements and the severity of illness. However, two severely affected children did not respond. Those with one or more daily bowel movements had less severe symptoms compared with those who had less than one movement a day ( $p = 0.0334$  for the total population; and  $p = 0.0038$  (odds ratio 0.124, 95% CI 0.021 to 0.733,  $p = 0.0214$ ) for children with a positive culture).

Children reported to empty their bowels at a regular time each day (group A/B/C: 50/77/46) clearly experienced less severe illness than those who had irregular habits (group A/B/C: 39/32/15) ( $p = 0.0261$ ). A daily morning bowel movement and/or more frequent bowel movements within the day (group A/B/C: 23/51/29) were associated with a reduced severity of illness compared with those who had bowel movements only at other times (group A/B/C: 66/58/32) ( $p = 0.0041$ ). In conclusion, a daily morning bowel movement and/or frequent movements were shown to be a protective factor against symptoms in *E coli* O157 infection of school age children.

## DISCUSSION

An investigation of the bowel habits of patients before an *E coli* O157 infection is unprecedented. As medical records are usually made at the time of presentation with an illness and a history of bowel habits prior to infection is rarely recorded, a study showing the relation between the frequency of movements and severity of illness could not be carried out using standard medical records.

Adhesion of enterotoxigenic *E coli* (ETEC) to the intestinal mucosal cell surface, followed by production of verotoxins that cause haemorrhagic colitis and HUS, may be an important factor in the pathogenesis.<sup>3</sup> More frequent bowel habits would protect not only against intestinal *E coli* O157 infections, but also other ETEC strains, by reducing the transit time. The risk factors for HUS or thrombocytopenic purpura include old age<sup>4</sup> and mental retardation.<sup>5</sup> In addition, antimotility agents are associated with the progression of enteritis to HUS<sup>6</sup> as a result of the same condition. We believe the hypothesis raised by our study deserves further examination in future studies.

**Abbreviations:** ETEC, enterotoxigenic *E coli*; HUS, haemolytic-uraemic syndrome

**Table 1** Daily bowel movements and the severity of illness

Bowel movements	Bloody stool (Group A)	Diarrhoea and abdominal pain (Group B)	No symptoms (Group C)	Number of admissions
Total population				
>1/day	5 (19.2)	11 (42.3)	10 (38.5)	0
1/day	50 (30.5)	69 (42.0)	38 (23.2)	7 (4.3)
1/two days	23 (40.3)	25 (43.9)	9 (15.8)	4 (7.0)
1/three days	6 (60.0)	4 (40.0)	0	4 (40.0)
<i>E coli</i> O157 positive				
>1/day	1 (11.1)	3 (33.3)	5 (55.6)	0
1/day	10 (27.0)	16 (43.2)	11 (29.7)	4 (10.8)
1/two days	9 (69.2)	4 (30.8)	0	2 (15.4)
1/three days	3 (75.0)	1 (25.0)	0	3 (75.0)

Percentages in parentheses.

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## REFERENCES

- 1 Reily LW, Remis RS, Helgelson SD, *et al.* Hemorrhagic colitis associated with a rare *Escherichia coli* serotype. *N Engl J Med* 1983;**308**:681–5.
- 2 Task force on the mass outbreak of diarrhoea in school children of Sakai City. Report on the outbreak of *E. coli* O157 infection in Sakai City. Sakai City, 1997.
- 3 Karmali MA, Petric M, Steele BT, *et al.* Sporadic cases of haemolytic-uremic syndrome associated with faecal cytotoxin-producing *Escherichia coli* in stools. *Lancet* 1983;**1**:619–20.
- 4 Carter AO, Borczyk AA, Carlson JAK, *et al.* A severe outbreak of *Escherichia coli* O157:H7-associated hemorrhagic colitis in a nursing home. *N Engl J Med* 1987;**317**:1469–500.
- 5 Pavia AT, Nichols CR, Green DP, *et al.* Hemolytic-uremic syndrome during an outbreak of *Escherichia coli* O157:H7 infections in institutions for mentally retarded persons: clinical and epidemiologic observations. *J Pediatr* 1990;**116**:544–1.
- 6 Cimolai N, Carter JE, Morrison BJ, *et al.* Risk factors for the progression of *Escherichia coli* O157:H7 enteritis to hemolytic-uremic syndrome. *J Pediatr* 1990;**116**:589–92.