HUMAN CAMPYLOBACTER-ASSOCIATED ENTERITIS ON THE CARIBBEAN ISLAND OF BARBADOS

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Abstract. A longitudinal study of the incidence of Campylobacter enteritis in Barbados was undertaken from January 2000 to August 2003. Diarrheal stools received by the central public health laboratory were cultured for Campylobacter. The number of reported Campylobacter cases exceeded those of Shigella but were less than those of Salmonella, and increased steadily with each year. Isolates from stools were mainly C. jejuni (63.6%) and C. coli (31.8%). The highest isolation rate was found in children 1–4 years of age (40.8%), followed by infants less than 1 year of age (16.9%) and those 5–9 years of age (11.3%). The number of reported cases was higher in March, from June to August, and in November and December. There was no correlation between incidence and either rainfall, temperature, or humidity. Further epidemiologic investigation of this disease is needed to evaluate risk factors for Campylobacter infection and determine routes of transmission in Barbados.

INTRODUCTION

Campylobacter jejuni is the leading bacterial cause of gastroenteritis in the developed world, where infection is typified by mild-to-severe, bloody diarrhea with a marked increase in incidence during the summer months. Less developed countries present a different epidemiologic picture of Campylobacter infection with frequent asymptomatic infections, milder illness, less striking seasonal variation in incidence, and peaks in occurrence in different age groups. Interestingly, in a recent report, the age distribution of South Asian cases in Birmingham, United Kingdom was similar to that of a developing country. It was preceded by another report from England describing differences in the epidemiology of Campylobacter enteritis based on ethnicity.

The incidence of Campylobacter infection in developing countries is generally much higher than in the developed world. In England and the United States, the annual incidence of Campylobacter enteritis is approximately 50/100,000 for the entire population and approximately 300/100,000 for children between the ages of one and four. Conversely, studies in Mexico and Thailand reported incidences more in the order of 40,000/100,000 in children less than five years of age. However, in developing countries, the rate of asymptomatic carriage is also much higher. The actual incidence of Campylobacter enteritis in most developing countries is not known because of the absence of national surveillance programs to monitor sporadic cases and outbreaks of infection.

Barbados is a small, developing country in the eastern Caribbean with a population of 276,607 (July 2002 estimate), making it one of the most densely populated islands in the region. It has a tropical climate with a dry season from November to May and a wet season from June to October. The contribution of Campylobacter spp. to childhood gastroenteritis in Barbados was recognized as early as 1988. After the worldwide emergence of Campylobacter as an important enteropathogen, its role in local diarrheal disease was again documented by Applewaithe and Levett, and in the same year, routine screening of diarrheal stools for the presence of Campylobacter spp. was initiated in Barbados.

We present a brief analysis of human Campylobacter-associated enteritis in Barbados since 2000. The data suggests that it is primarily a disease of children due to infection with predominantly C. jejuni.

MATERIALS AND METHODS

Diarrheal stools received by the Public Health Laboratory of the Winston Scott Polyclinic (WSPC) from January 2000 to August 2003 were examined for the presence of Campylobacter. Feces was streaked onto modified cefoperazone charcoal deoxycholate agar (mCCDA) (Campylobacter blood free agar base; Oxoid Ltd., Basingstoke, United Kingdom) supplemented with CCDA selective supplement (Oxoid Ltd.) and incubated at 42°C for 48 hours in a microaerophilic atmosphere generated using the CampyGen gas generating system (Oxoid Ltd.). Isolates were Gram stained and subjected to the oxidase test. Suspected Campylobacter isolates were sent to the Microbiology Research Laboratory (University of the West Indies, Cave Hill Campus) for further characterization and identification. The INDX®Campy (jcl)® culture confirmation latex agglutination test (PanBio INDX, Inc., Baltimore, MD) and genus-specific C412F/C1228R primers were used in a polymerase chain reaction (PCR) to confirm isolates.

The hippurate hydrolysis test was used to identify C. jejuni among isolates. Hippurate hydrolysis–positive isolates were confirmed as C. jejuni by PCR with the q hip primer pair and C. coli was identified by PCR with the cc asp primers as described by Lawson and others.

RESULTS

Since the initiation of screening in 2000, the number of cases of Campylobacter enteritis reported at the WSPC has increased each year (Table 1). A significantly greater number of stools were submitted in 2003 and fewer stools were cultured in 2002 (Table 1). Based on reports from the WSPC, the estimated annual incidence ranged from 5.4/100,000 inhabitants in 2000 to 10.8/100,000 in 2002. Over the same period, there was a decrease in the number of cases of gastroenteritis caused by Salmonella and Shigella, although Salmonella was
isolated more frequently than Campylobacter. The incidence of Campylobacter enteritis was significantly higher for the 0–4-year-old age group compared with other age groups (P < 0.0001) (Table 2). For the same age group, a significantly greater number of stools were cultured for Campylobacter (P < 0.0001) and a significantly higher isolation rate was recorded (P = 0.0054) (Table 2).

More than 50% of recorded cases of Campylobacter enteritis occurred in children less than five years of age (Figure 1). There were 10 cases in adults (≥ 18 years of age) and four geriatric cases (50 years of age), including one of an unknown age. There was also one case in a neonate whose age was not recorded. A total of 10.5% of the cases were inpatients at Queen Elizabeth Hospital in Barbados, 88.2% were outpatients from the community, and there was one case from the Geriatric Hospital. Two small family outbreaks were recorded: one involved twin infants and the other involved a nine-year-old boy and his grandmother. During the study period, small peaks in incidence have been observed during March, from June to August, and during November and December (Figure 2). Forty-four suspected Campylobacter isolates were received in a viable state. Of these, 28 (63.6%) were C. jejuni, 14 (31.8%) were C. coli, and 2 (4.6%) could not be identified.

Statistical analysis using Pearson’s product moment correlation coefficient did not find a significant correlation between the number of cases and either rainfall, temperature, or humidity. (Weather data for November were not available for 2000–2003.) For 2000–2002, 61.3% of the cases occurred during the dry season, but this difference was not statistically significant (χ2 = 0.215, P = 0.6428).

**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella spp.*</td>
<td>133</td>
<td>77</td>
<td>87</td>
<td>62</td>
</tr>
<tr>
<td>Shigella spp.*</td>
<td>20</td>
<td>7</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Campylobacter spp.</td>
<td>15</td>
<td>17</td>
<td>30</td>
<td>16†</td>
</tr>
<tr>
<td>Total cases analyzed‡</td>
<td>1,132</td>
<td>1,331</td>
<td>1,111</td>
<td>2,631</td>
</tr>
</tbody>
</table>

* Data for Salmonella and Shigella were obtained from the records of the WSPC. Diarrheal stools are also routinely cultured for these two enteropathogens.
† Testing was discontinued after August due to unavailability of media and reagents required for isolation of Campylobacter.
‡ Total number of cases that were analyzed for the presence of all three enteropathogens listed. Testing for Salmonella and Shigella is also conducted on stools from asymptomatic individuals who are food handlers.

**Table 2**

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Culture rate (%)</th>
<th>Stool positivity rate (%)</th>
<th>Incidence (cases per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>1.80</td>
<td>3.32</td>
<td>59.8</td>
</tr>
<tr>
<td>5–9</td>
<td>0.26</td>
<td>3.96</td>
<td>10.3</td>
</tr>
<tr>
<td>10–14</td>
<td>0.15</td>
<td>2.48</td>
<td>3.8</td>
</tr>
<tr>
<td>15–19</td>
<td>0.15</td>
<td>2.50</td>
<td>3.7</td>
</tr>
<tr>
<td>20–29</td>
<td>0.18</td>
<td>1.71</td>
<td>3.1</td>
</tr>
<tr>
<td>30–39</td>
<td>0.16</td>
<td>0.76</td>
<td>1.2</td>
</tr>
<tr>
<td>40–49</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50–59</td>
<td>0.18</td>
<td>0.52</td>
<td>0.9</td>
</tr>
<tr>
<td>&gt; 59</td>
<td>0.28</td>
<td>2.23</td>
<td>6.1</td>
</tr>
</tbody>
</table>

* The rate at which the population is cultured: the number of individuals whose stool was tested for Campylobacter divided by the number of individuals in the total population.
† The number of stools positive for Campylobacter divided by the number of stools analyzed.

**DISCUSSION**

The Public Health Laboratory of WSPC is the center for screening of diarrheal stools for a variety of enteropathogens. It receives stool specimens from patients with diarrhea who have been admitted to the island’s chief hospital (Queen Elizabeth Hospital), those at the Accident and Emergency Department of this hospital, from all polyclinics across the island, and from several private general practitioners and pediatricians. There are a few private diagnostic laboratories on the island that may occasionally analyze stools for Campylobacter; however, such testing is not performed on a routine basis. We therefore believe that data from the WSPC laboratory gives an adequate representation of the overall situation with Campylobacter enteritis on the island.

The observed increase in the number of cases of gastroenteritis caused by Campylobacter spp. since 2000 and the concurrent overall decrease in cases caused by Salmonella and Shigella emphasize the importance of this enteropathogen as a cause of diarrhea in Barbados. This increase in the number of reported cases could be the result of greater awareness of its disease potential and the subsequent increase in the number of stools examined for Campylobacter spp.

The crude estimate of annual incidence of Campylobacter in Barbados is low compared with Curacao (120/100,000 for 1999–2000). However, Campylobacter enteritis is not a notifiable disease in Barbados and it is likely that not all cases are reported because of failure to consult a physician or to submit a stool specimen for culture, or because a specimen was processed at a private laboratory, in which case the WSPC would not necessarily be notified.

Our data suggest that Campylobacter enteritis is mainly a pediatric disease because most cases occurred in individuals 1–4 and 5–9 years of age and only 14.1% of the total cases occurred in adults. This is consistent with the picture in other developing countries. Two studies of Campylobacter enteritis conducted in neighboring Caribbean islands have yielded conflicting results. In Trinidad, C. jejuni was a significant cause of gastroenteritis in children less than three years old, whereas in Guadeloupe, it was not isolated from any cases in children less than two years of age. Campylobacter was the third most common pathogen isolated from Brazilian children with acute diarrhea. In developing parts of Asia and in parts of Africa, a similar picture was observed, although Campylobacter is generally not as common as Shigella, Salmonella, Vibrio, enteropathogenic Escherichia coli, and rotavirus. Thus, the age-related incidence of Campylobacter enteritis in Barbados is characteristic of a developing country.

Adults in Barbados tend to seek medical attention for diarrhea only in severe cases or cases of protracted illness requiring prolonged absence from work. Only a small proportion of these individuals who consult a physician will be required to submit a stool sample for analysis. Furthermore, depending on the physician, a test for Campylobacter may not be requested, and seeing that such testing is not routinely performed by most of our laboratories, it is likely that adult...
cases of Campylobacter enteritis would go undetected. An assessment of the seroprevalence within our population may substantiate whether this is largely a pediatric disease.

Small variations in the isolation frequency were observed at different times of the year but overall the distribution of cases was quite even. This pattern is different from the striking seasonality noted in industrialized countries and from that noted in some developing countries, where most cases were reported during the dry season.\textsuperscript{4,28} We did not find a significant association between the incidence of Campylobacter-associated enteritis and either rainfall, temperature, or humidity, factors that would affect the ability of Campylobacter to survive in the environment. The absence of such a correlation may be linked to the tropical climate of the island, which features little overall variation in these parameters compared with that of a temperate country. The unavailability of weather data for the month of November, a time of year when the number of cases begins to peak, would also have affected the results of the statistical analysis. In contrast, on the island of Curacao, epidemics of Campylobacter enteritis were associated with the rainy season and cases were significantly associated with the presence of a deep well in or around the house, suggesting that water is a source of infection.\textsuperscript{17}

We observed a small increase in the number of reported cases from June to August. Similarly, Applewaithe and Levett reported a peak in incidence of diarrhea caused by this pathogen, as well as Salmonella and Shigella spp. during these months.\textsuperscript{14} The Crop Over Festival (local carnival) in Barbados spans these months and during this period there are many social events at which food is sold from small, temporary, outdoor stalls. These food stalls are sometimes operated by personnel who are not experienced food handlers. Increased consumption of such fast foods may explain the increase in cases during this period. Likewise, the peak at the end of the year may be linked to similar activities surrounding Independence Day (November 30) in Barbados and Christmas celebrations. Estevez-Touzard and others also reported a higher incidence of childhood diarrhea caused by Campylobacter in the winter months, which also coincides with the dry season.\textsuperscript{28} The possible contribution of increased tourist arrivals during winter months cannot be overlooked. However, it is not believed to be a likely source of infection.

The predominance of \textit{C. jejuni} among clinical isolates is a
worldwide phenomenon. However, the proportion of our isolates that were C. jejuni is unlike that of developed countries where C. jejuni accounts for more than 90% of cases.\textsuperscript{29,30} Our species distribution more resembles that recorded in Chile, Hong Kong, and the Central African Republic, where C. jejuni and C. coli are isolated from clinical cases at an almost equal rate.\textsuperscript{3} The absence of epidemic cases is another feature of \textit{Campylobacter} enteritis in Barbados that is typical of a developing country.

The source of human infection in Barbados is not known, although chickens have been suggested as a likely vehicle of infection.\textsuperscript{14} However, with the steady increase in the number of cases of \textit{Campylobacter} enteritis and the possibility of patients developing Guillain-Barré syndrome and other complications, an investigation into the epidemiology of this disease is warranted. A more detailed examination of the history of individual cases, particularly with respect to recent contact with animals and consumption of animal food products, will aid in defining risk factors for infection and possible transmission routes. Knowledge of the source of infection is vital to the effective management of any disease. An epidemiologic case-control study is also recommended. In the meanwhile, public health authorities should aim at increasing awareness of this disease both at the level of the community and within the medical fraternity.

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