THE EPIDEMIOLOGY OF VIBRIO CHOLERAE IN ZABOL CITY, SOUTHEAST OF IRAN


Background: Cholera continues to be an important public health problem in many communities.

Objective: This study was performed to determine the epidemiology of Vibrio cholerae in Zabol city, South-East of Iran.

Methods: The study was conducted in the hospitals affiliated to Zabol Faculty of Medicine, with patients referred from Zabol city and its 45 neighboring rural populations. Three thousand one hundred seventy-eight patients with watery diarrhea, who were referred to this center, were investigated in a descriptive retrospective study over a 4-year period.

Results: Vibrio cholerae strains were isolated from 362 (11.39%) samples. Of these, 336 (92.8%) were found to be Vibrio cholerae O1 Ogawa strain. Nonagglutinable (NAG) vibrios accounted for 26 (7.2%) strains. Twenty-four cases lived in an urban area, 270 had been referred from rural areas, and 68 came from Afghanistan. Two hundred forty-four cases were inpatients while the remaining 118 were outpatients. Twelve (3.31%) of these patients died of the disease.

Conclusion: Vibrio cholerae remains an important cause of acute watery diarrhea in Sistan and Baluchestan Province of Iran especially rural area.

Keywords: Cholera • diarrhea • Iran • prevalence

Introduction

Cholera is an acute intestinal infection caused by the bacterium Vibrio cholerae. Cholera is a historically-feared epidemic of diarrheal disease that remains a major public health problem in many parts of Africa, Asia, and Latin America.1, 2 Though rare in developed countries, cholera is still an important infection worldwide.1 In the last decades, attention to cholera epidemiology increased, as cholera epidemics became a worldwide health problem.

Detailed investigation of V. cholerae interactions with its host and with other organisms in the environment suggest that cholera dynamics are much more complex than previously thought.3

After the isolation and description of V. cholerae by Koch at the end of the 19th Century, the 20th Century witnessed the description of the classical and El Tor biotypes, and the development of the 7th global pandemic beginning in Sulawesi in 1964, extending through the South and southeastern Asia, and much of Africa in the 1970s, and into the South America in the 1990s.2 In 1992, V. cholerae O139 was isolated in southern India and was the first non-O1 serotype responsible for cholera epidemics.4 The pandemic is still ongoing in many countries.3, 5 – 8 These epidemics show that it is still not possible to predict when and where a new outbreak of cholera might be started, that appropriate therapy may
reduce the mortality to values below 1%, and that changes in the etiology of this ancient disease are still taking place.1

*V. cholerae* is a curved Gram-negative bacillus that belongs to the family Vibrionaceae and shares common characteristics with the family Enterobacteriaceae.1 The species *V. cholerae* includes both pathogenic and nonpathogenic strains, differing in their virulence gene contents and polysaccharide surface antigens. Only *V. cholerae* O1 and O139 are responsible for the disease defined clinically and epidemiologically as cholera. *V. cholerae* O1 is divided into classical and El Tor biotypes, and into three sero-subtypes—Ogawa, Inaba, and Hikojima. *V. cholerae* O139 has characteristics in common with the El Tor biotype, however it differs from O1 in its polysaccharide surface antigen.2

The survival of *V. cholerae* in aquatic environments, and the potential role of this reservoir in subsequent disease outbreaks, have been described in several studies.9 Cholera has unique epidemiologic features. Based on the epidemiologic pattern, recognizing the different age groups at risk is useful in designing preventive measures.1 This study was conducted to determine the epidemiology of *V. cholerae* in Zabol city, South-East of Iran.

**Patients and Methods**

This descriptive retrospective study was conducted in Zabol, a city in Sistan-Baluchestan Province, South-East of Iran and the West of Afghanistan. Between July 1997 and August 2000, 3,178 patients with watery diarrhea were referred to hospitals affiliated to Zabol Faculty of Medicine, from Zabol city and its 45 neighboring rural areas.

The diagnosis of cholera remains primarily a clinical diagnosis for the management of individual patients, however laboratory confirmation is necessary in epidemiological investigations and where statutory information is required.2 Therefore, rectal swabs of all cases were collected and processed according to the standard procedures for isolation of *V. cholerae*.

A two-page questionnaire was developed to obtain demographic information including: name, gender, date of birth, place of birth, clinical status, therapeutic status, result of therapy, *V. cholerae* serotype, and health system status. Data were analyzed by a software developed by the authors.

**Results**

*V. cholerae* was isolated from 362 samples (218 males and 144 females)—i.e. a culture detection rate of 11.39% (Table 1). The age of these patients ranged from 1 to 65 years (Figure 1). Twenty-six percent of all isolates were from children under the age of 5 years. All age, social, and economic groups were affected; 17% of the affected families had more than one patient, including 39 families with 2 patients, 17 with 3 patients, and 8 with 3 patients.

Among the patients with cholera, only 24 (6.6%) lived in urban areas, whereas 270 (74.6%) were referred from rural areas; the remaining 68 subjects (18.8%) came from the neighbor country, Afghanistan (Table 2). Two hundred and twenty-two (61.3%) of patients were Iranian while 140 (38.7%) were from the Afghan population.

The drinking water supply of the affected people was mainly from surface water (85.1%)—including rivers (n = 289) and springs (n = 19). Nevertheless, 54 (14.9%) patients consumed ground water from wells. The water distribution was by water pipe (n = 209), water cask (n = 129), and water tank (n = 24).

The latrine hygiene at the place of residence was found sanitized for only 53 (14.7%) patients and unsanitized for 272 (75.1%) cases. Moreover, there was no toilet available in the house for the remaining 37 (10.2%) patients.

Of these 362 isolates, 336 (92.8%) were found to be *V. cholerae* O1 Ogawa strain. Nonagglutinatable (NAG) vibrios accounted for 26 (7.2%) strains. Inaba and Hikojima sero-subtypes

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**Table 1. Patients with Vibrio cholerae detected between 1997 and 2000.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of patients with diarrhea</th>
<th>Number of patients with <em>V. cholerae</em></th>
<th>V. cholerae percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
</tr>
<tr>
<td>1997</td>
<td>712</td>
<td>99</td>
<td>61</td>
</tr>
<tr>
<td>1998</td>
<td>1413</td>
<td>65</td>
<td>54</td>
</tr>
<tr>
<td>1999</td>
<td>739</td>
<td>45</td>
<td>23</td>
</tr>
<tr>
<td>2000</td>
<td>314</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>3178</td>
<td>218</td>
<td>144</td>
</tr>
</tbody>
</table>
were not found in our sample.

Two hundred and forty-four of the subjects were inpatients and the remaining 118 were outpatients. Twelve (3.31%) of the subjects died of severe dehydration and electrolyte imbalance. Six of them died in the first year of the study (1997), four in 1998, one in 1999, and another in 2000. The results of the management in the remaining patients were excellent.

Discussion

Cholera is a disease of history that remains a major public health problem in many parts of Africa, Asia, and Latin America. Cholera continues to be an important public health problem among many poorer and vulnerable communities, despite the detailed understanding of the bacteriology, epidemiology, and public health aspects for more than a century. Three hundred and sixty-two patients with cholera were reported in our study, that translates to a prevalence rate of 11.39% (95% CI: 10.29% – 12.50%) among 3,178 patients with watery diarrhea.

Geographic information systems have been utilized to assess spatial distribution of cholera at the local level, demonstrating case clustering and disease risk areas. Modeling techniques using climate data, remote monitoring, and geographic information systems provide new techniques that may contribute to the prediction of cholera epidemics. V. cholerae O1 Ogawa was found in 9.35% of the 3,594 samples taken from patients with diarrhea. Although this rate was similar to the culture detection rate in a study by Nizami et al in our neighboring country, Pakistan, it is lower than the rate in a recent study in that country. Although cholera is an endemic disease in Bangladesh and India, it was never a significant cause of gastroenteritis in Pakistan before 1988. Since then, cases of cholera have been identified each year, both in adults and children in Pakistan. Of 4,346 children hospitalized with gastroenteritis in Karachi, Pakistan from 1990 through 1995, 348 (8%) children were confirmed to have cholera mostly because of V. cholerae Ogawa biotype.

<table>
<thead>
<tr>
<th>Year</th>
<th>Iran</th>
<th>Rural area</th>
<th>Afghanistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>6</td>
<td>131</td>
<td>23</td>
</tr>
<tr>
<td>1998</td>
<td>11</td>
<td>81</td>
<td>27</td>
</tr>
<tr>
<td>1999</td>
<td>5</td>
<td>55</td>
<td>8</td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>270</td>
<td>68</td>
</tr>
</tbody>
</table>

Figure 1. Age distribution of patients with V. cholerae, 1997 – 2000.
The hallmark of cholera is the production of watery diarrhea with varying degrees of dehydration ranging from none to severe and life-threatening diarrhea. Laboratory abnormalities reflect the isonic dehydration characteristic of cholera. The goal of therapy is to restore the fluid lost through diarrhea and vomiting. This management was performed for all of our patients, 67.4% of whom were admitted to hospital. However, 3.31% of them died of severe disease (severe dehydration and electrolyte imbalance). Rapid and appropriate rehydration is, therefore, the principal management intervention in cholera. Early access to appropriate medical care, where available, is an important factor in reducing case fatality rates. Early detection of cases and an effective surveillance system to direct scarce resources will result in more timely and appropriate case management. While rehydration is the mainstay of patient management, the use of appropriate antimicrobials may both reduce the severity of diarrhea and the duration of excretion of *V. cholerae*. In selected circumstances, antimicrobial prophylaxis for case contacts may contribute to reducing transmission. Tetracycline, furazolidone, and doxycycline have been the antimicrobials recommended, though in many places where cholera is endemic, tetracycline may be the only antimicrobial available.

In our study, cases of cholera were identified each year, both in adults and children, until 2000. Despite rapid urbanization and increasing affluence in the southeastern Iran, cases of cholera had been frequent. The reproduction rate of cholera in a community is defined by social and environmental factors. The importance of the aquatic reservoir depends on the sanitary conditions of the community. Cholera is spread mainly through drinking fecal-contaminated water. When cholera appears in a community, it is essential to ensure three things, namely hygienic disposal of human feces, an adequate supply of safe drinking water, and good food hygiene. The most useful measure in preventing the spread of cholera is the provision of safe drinking water and sanitary disposal of human feces. While contaminated water remains the major route for cholera transmission, food and utensils are also important, emphasizing the importance of hygiene within the household. Effective food hygiene measures include cooking food thoroughly and eating it while still hot; preventing cooked foods from being contaminated through contact with raw foods, including water and ice, contaminated surfaces or flies, and avoiding raw fruits or vegetables unless they are first peeled. Washing hands after defecation and, particularly, before contact with food or drinking water, is equally important. There are several means by which we try to prevent waterborne disease transmission. Among these are two categories of infection-control practices. The first category represents the establishment of physical barriers to prevent contamination of the water used for recreation as the source of drinking water. The second category consists of water treatment for disinfection. Providing potable water and ensuring proper management of excreta to avoid contamination of other water sources were important measures to reduce cholera transmission. It should...
be mentioned that while there is extensive laboratory work in the development of new cholera vaccines, their appropriate role in public health is still not certain.2

Education of the population at-risk regarding appropriate hygienic practices is always recommended. Identification of local customs that place people at-risk is also important in order to eliminate such practices.1 Further development of cholera control requires a better understanding of V. cholerae ecology and epidemiology.

Priorities for cholera control remain public health interventions through improved water and sanitation, improved surveillance and access to health-care facilities, and further developments to make appropriate vaccines. A greater understanding of the pathogen, its biology, ecology and epidemiology, and strategies for treatment and prevention are essential to guide policies and programmes for the control of cholera. The global reduction of the burden of cholera as a public health problem requires international and national action to improve public health and to reduce the vulnerability of disadvantaged communities.2

It is important to consider V. cholerae when empirically treating diarrheal diseases in our region. Adequate measures to improve hygiene and sanitation and the supply of safe potable water are needed to prevent any future epidemic of cholera in Zabol city.

References


