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ORIGINAL ARTICLE

The epidemiology and antimicrobial resistance of cholera cases in Iran during 2013

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ABSTRACT

Background and Objectives: Cholera is an endemic diarrheal disease in Iran, caused by *Vibrio Cholerae*. The epidemiology, transmission route, environmental determinants and antimicrobial resistant pattern of cholera have been changed during recent years. In this study the epidemiology and antimicrobial resistance of cholera in Iran during 2013 outbreak was investigated.

Materials and Methods: A retrospective, cross-sectional study was carried out using cholera national surveillance system collected data in 2013. Bacterial identification and antimicrobial susceptibility testing were done on 60 *Vibrio cholerae* isolates, serotype Inaba.

Results: During July to November 2013, 256 confirmed cholera cases were diagnosed by stool culture. Two hundred and eleven out of 256 (83%) cases were imported from Afghanistan and Pakistan. The prevalent age group was 16-30 years old, 90% were male, 98.8% affected by Inaba serotype and case fatality rate was 2.7%. The results of antimicrobial susceptibility testing on 60 *V. cholerae,* serotype Inaba showed that all isolates were resistant to nalidixic acid, tetracyclin and trimethoprim-sulfamethoxazole and intermediate resistance to erythromycin but sensitive to ciprofloxacin, cefixime and ampicillin.

Conclusion: Migrants from neighboring countries played a key role in cholera outbreak in Iran during 2013. The results of antimicrobial susceptibility testing on 60 *V. cholerae,* serotype Inaba showed an increasing resistance rate in comparison with previous years.

Keywords: Cholera, Epidemiology, Antimicrobial Resistance, Iran

INTRODUCTION

Cholera is an endemic diarrheal disease in Iran, caused by *V. cholerae.* The most important symptom of disease is severe acute diarrhea that can result in severe dehydration and electrolyte imbalance, therefore causes a high mortality (1, 2). During recent decades, attention to cholera epidemiology increased, as cholera epidemics became a global health problem. Detailed investigation of *V. cholerae* interactions with its host and with other environmental determinants suggest that cholera dynamics are much more complex than previously thought (3). Despite of dra-

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matically decrease in typhoid fever incidence in Iran during last decades, due to accessibility to safe water (4), poor water sanitation system and inaccessibility to safe water mostly in rural area play a key role in emergence of cholera outbreaks. There is a strong link between cholera outbreaks and climate factors such as temperature and humidity (5). Age can be a risk factor to cholera morbidity, even neonates can be affected to invasive *V. cholerae* infection (6). Children are more affected during non-epidemic cholera years because of first exposure and less immunity, meanwhile, the age group of above 15 year-olds was more affected to cholera during epidemic years (7). In recent years, there were reported large outbreaks in some area, for instance, in 2012, 49% of all reported cases originated from a large outbreak which continued to affect Haiti and the Dominican Republic (8). In 2005, as a cholera epidemic in Iran, 1133 confirmed cases were reported in the country (9-13). Southeastern provinces in Iran such as Sistan-Baluchestan is more affected by cholera especially due to ungovernable border crossing, threaten the province population (14, 15). The epidemiology, transmission route, environmental determinants and resistant pattern of cholera have been changed during recent years. The aim of this study was to investigate the epidemiology and antimicrobial resistance of cholera in Iran during 2013.

MATERIALS AND METHODS

A retrospective, cross-sectional study was carried out using cholera national surveillance system collected data in 2013. All suspected and confirmed cases data and results of sporadic and outbreak epidemiologic investigation have been reported by questionnaire to the department of food-borne and waterborne in Center for Communicable Disease Control from all provincial health centers. Collected data were analyzed using SPSS.18 software.

Bacterial identification and antimicrobial susceptibility testing. The *V. cholerae* isolates were received from 11 province of Iran during July to November, 2013. Identification of the isolates was confirmed in reference Laboratory in Ministry of Health and Medical Education using standard biochemical and bacteriological tests. All isolates were examined for specific serogroups by O1 polyvalent and Ogawa/Inaba monospecific antisera (BD, Becton–Dickinson Co.USA). Performance of susceptibility testing all of 60 isolates were tested by MIC test strip method using Liofilchem (CE IVD approved, Italy) against ciprofloxacin, nalidixic acid, cefixime, ampicillin, tetracycline, sulfamethoxazole, trimethoprim (SXT), and erythromycin (Table 2). The definitions of MICs as sensitive, intermediate, and resistant levels are shown in Table 2.

RESULTS

Results of analyzed cholera outbreak in 2013 in Iran showed that more than 211 (83%) cases were imported from Afghanistan and Pakistan by epidemiologic investigation of cases (Table 1). They were young immigrants between 16 to 30 years old (66.1%) and were all male who had traveled illegally to Iran for job opportunities (Table 1). During 2013, more than 190000 stool sample from suspected diarrheal patients were tested throughout country. The results of epidemiologic investigation of positive cases and distribution of cases by provinces are shown in Table 1 and Figs 1 and 2. Because of delay in referring to hospital and the severity of their disease, the case fatality rate was high (Table 1) and three died before arriving to hospital. The results of antimicrobial susceptibility testing on 60 *V. cholerae,* serotype Inaba showed an increasing resistance rate than previous years (Table 2). All isolates were resistant to nalidixic acid, tetracyclin and trimethoprim-sulfamethoxazole.

DISCUSSION

Cholera continues to be an important concern in developing countries. Cholera is spread mainly through drinking fecal-contaminated water. When cholera occur 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 best way to prevent the spread of cholera is the provision of safe drinking water, sanitary disposal of human feces and environmental management (16). As a result of national developmental projects such as increased accessibility to safe water during recent years in Iran, contaminated water is not a main rout of cholera transmission, therefore contaminated

food especially vegetables irrigated with raw sewage are concerned (17). Investigations of cholera epidemics in Iran during 2005 showed that consumption of contaminated vegetable was the main rout of transmission (12). Based on the result of this study, high risk groups for cholera are rural populations and foreigners. Immigrants from Afghanistan and Pakistan played a key role in cholera outbreak in Iran during 2013 because of poor water sanitation system and inaccessibility to safe water in the immigrant camps (Table 1). Among 256 total confirmed cholera cases in Iran during 2013 more than 211(83%) of cases were

Table 1. Results of analyzed cholera outbreak in Iran, 2013(N=256)

	N	%
Frequency of cholera cases by months		
July	3	1.2
August	40	15.6
September	150	58.6
October	61	23.8
November	2	0.8
Frequency of cholera cases by age groups		
0-5	9	3.5
6-10	7	2.7
11-15	5	2
16-20	55	21.5
21-25	79	30.9
26-30	35	13.7
31-35	21	8.2
36-40	14	5.4
41-45	10	3.9
46-50	5	2
51-55	6	2.3
56-60	3	1.2
>60	7	2.7
Frequency of cholera cases by gender		
Male	229	90
Female	27	10
Frequency of cholera cases by locality		
Urban area	69	27
Rural area	187	73
Frequency of cholera cases by nationality		
Iranian	45	17
Afghani's	210	82
Pakistani	1	1
Epidemiological classification of cholera cases		
Indigenous	45	17
Imported	211	83
Frequency of cholera cases by serotype		
Inaba	253	98.8
Ogawa	3	1.2
Frequency of cholera cases by treatment outcome		
Cured	249	97.3
Died	7	2.7

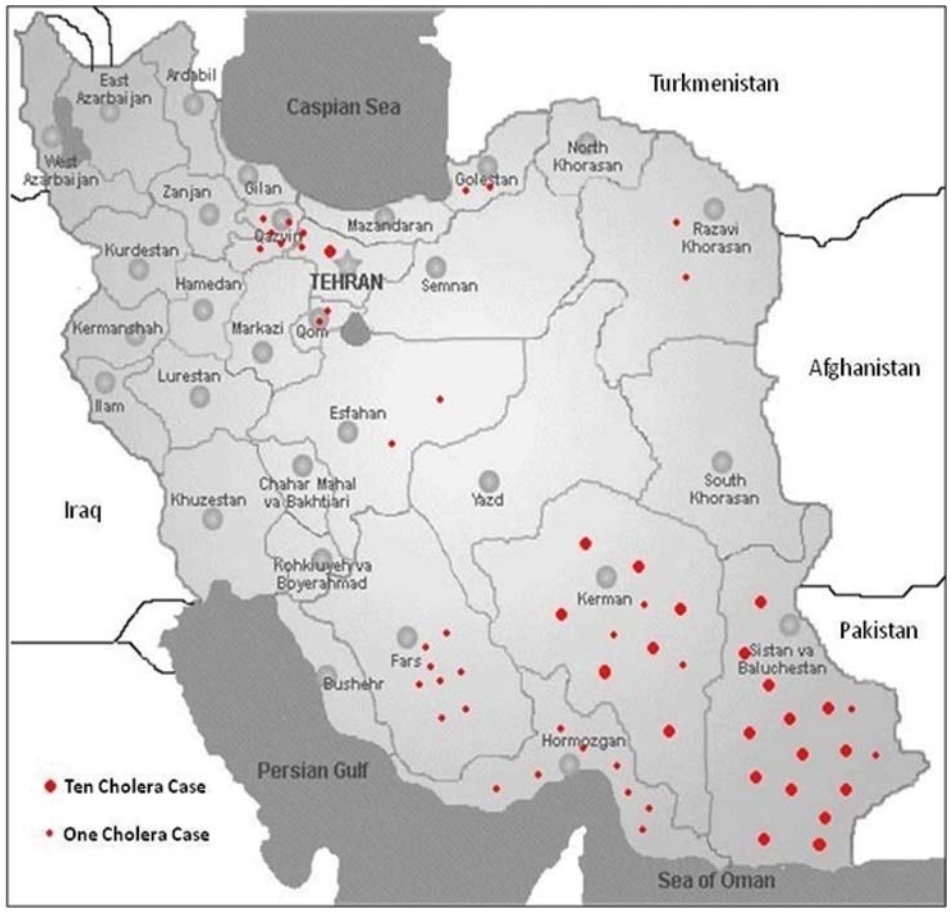

Fig. 1. Map of Iran showing distribution of cholera cases, 2013

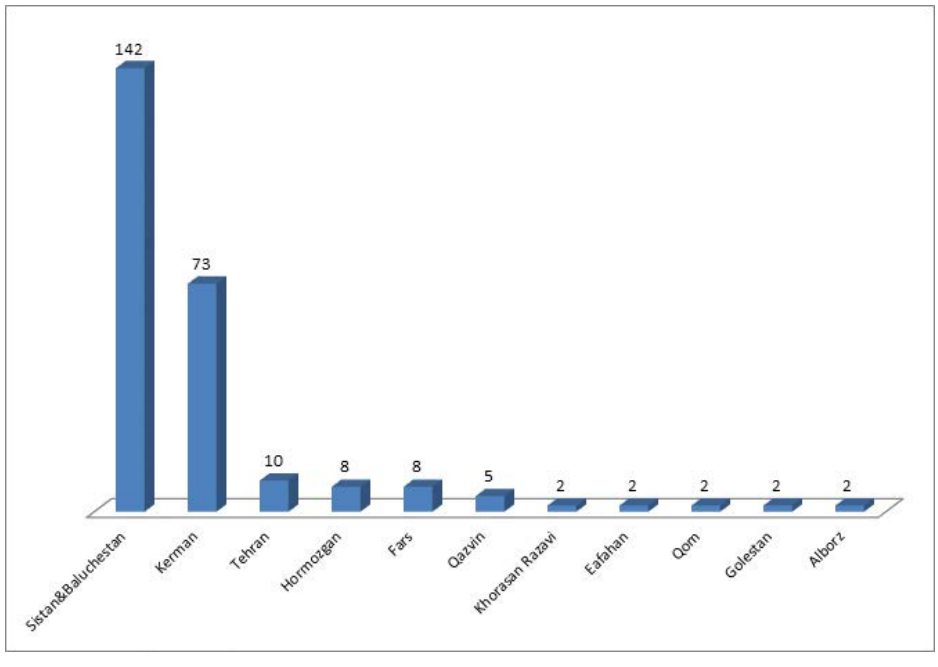

Fig. 2. Distribution of Cholera cases by provinces, Iran, 2013

Table 2. Results of analyzed *V. cholera,* serotype Inaba antimicrobial susceptibility testing, Iran, 2013 (N=60)

Antimicrobial Agent	Result			MIC Interpretive Standard (µg/mL)		
	S	I	R	S	I	R
Ciprofloxacin	100%	-	-	≤ 1	2	≥ 4
Nalidixic Acid	-	-	100%	≤ 16	-	≥ 32
Cefixime	100%	-	-	≤ 1	2	≥ 4
Ampicillin	100%	-	-	≤ 8	16	≥ 32
Tetracycline	-	-	100%	≤ 4	8	≥ 16
SXT	-	-	100%	-	-	-
Erythromycin	23%	77%	-	≤ 2	4-8	>8

S=Sensitive I=Intermediate R=Resistant SXT=Sulfamethoxazole, Trimethoprim

imported and the remainders were indigenous (18). In study of Khazaei in a six-year study on *V. cholerae* in southeastern Iran, 18.8% of cases were from neighboring Afghanistan (19). They were young immigrants between 16 to 30 years old (66.1%) and were all male who had traveled long way due to ungovernable border crossing for finding job opportunities (Table 1). The outbreak occurred in warm months from July to November mostly in rural areas of Sistan-Baluchestan and Kerman provinces (Figs 1 and 2). In 2013, case fatality rate (CFRs)<1% were reported by 4 countries and 17 countries reported a CFRs between 1% and 5%. This rate for Iran was 2.7% (18). Because of delay in referring to hospital and the severity of their disease, the case fatality rate was high and three of dead bodies were died before arriving to hospital. Meanwhile, CFRs of cholera in Iran during 2012 was zero (8). Our study showed there is a growing rate of antimicrobial resistance in comparison with previous years (Table 2). The study of Pourshafie et al. showed that 86, 84, 84 and 82% of the isolates were resistant to streptomycin, chloramphenicol, co-trimoxazole and tetracycline, respectively (20). Hajia et al. studied on 61 *V. cholera* isolates that showed all of the isolates were susceptible to three antimicrobial agents including ciprofloxacin, cefixime, and ampicillin. The highest rate of resistance was seen to nalidixic acid and co-trimoxazole with 96.7% and 91.8% respectively (21). Increasing rate of antimicrobial resistance will be a great challenge in control of cholera outbreaks in the future. In conclusion, immigrants from neighboring countries played a key role in cholera outbreak in Iran during 2013. The results of antimicrobial susceptibility testing on 60 *V. cholerae*, serotype Inaba showed an increasing resistance rate in comparison with previous years. Continuing and strengthening of cholera surveillance system and implementation of proper control measures especially for control of antimicrobial resistance are our recommendations.

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