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A Retrospective Study: Cholera in Baghdad 2015

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Abstract: From June to December 2015, Iraq's capital city, Baghdad, suffered a cholera epidemic. Al-Yarmouk Teaching Hospital (AYTH) is the second main hospital in Baghdad City, located close to the epidemic epicentre and recorded events as they unfolded. A retrospective audit of hospital records was done in this study. Clinical and sociodemographic data were collected on the population, including adult patients admitted to AYTH with a confirmed diagnosis of cholera by the Central Public Health Laboratory (CPHL). The confirmed cases were 940. Of those cases, 21% attended AYTH. Initial belt zone cases totalled 44.16% of hospital cases, of which 65 were dependent on agricultural products from neighbouring farms. All patients were positive for the Inaba Vibrio Cholera strain. Baghdad's cholera epidemic may have resulted from inhabitants' dependence on local water sources for agricultural needs. During summer, severed water supplies denied Baghdad's Dijla River water access forced farmers and locals to source well water. To protect the public and environmental safety, groundwater must be accurately and regularly tested in the region. Safe drinking water and sanitary toilet facilities must be guaranteed.

Keywords: Cholera Epidemic, Inaba Vibrio Cholera, Water Safety, Iraq, Environmental Safety, Clinical Data

1. Introduction

Unsafe water sources contribute significantly to the global burden of disease. Poor sanitation and hygiene lead to outbreaks and epidemics of communicable diarrheal diseases [1-7], causing1.7 million cases of childhood diarrhoeal diseases worldwide annually [8]. These hazards are amplified in low-middle income countries (LMICs), where fragmented health systems, poor protection, and control strategies, in addition to insufficient infrastructure and resources, are present [1]. For instance, environmental factors are estimated to cause 25% of total deaths and diseases globally, while in Sub-Saharan Africa, low-middle income countries (LMICs), this percentage reaches approximately 35% [2]. Global efforts currently focus on prevention strategies to control diarrheal diseases such as cholera outbreaks. However, inefficient health governance in LMICs stands as an obstacle against strategy implementation [3]. Nonetheless, some outbreaks have been successfully controlled in limited resources settings.

Cholera is caused by *Vibrio Cholera*, a gram-negative bacterium that mainly inhabits salty water, where it lives for eight weeks. In freshwater, it lives for only two weeks. Human transmission is through the faecal-oral route by ingesting bacteria in contaminated water or food [4-7, 9]. It is classified into two serogroups: O1 and O139. The O1 serogroup causes most outbreaks and has two distinct serotypes, Inaba and Ogawa, that do not differ in clinical presentation, bacteriological biopathology or management. However, this classification has immense public health and epidemiological importance in identifying the source of infection, particularly when cholera is first isolated in a country or a geographic area, where different environmental circumstances are observed [4-7, 9]. Recently, new pathogenic variants of *V. cholera* have surfaced and spread throughout many Asian and African countries with resultant cryptic changes in the epidemiology of cholera [10]. According to the WHO, vaccination should be considered for inhabitants of endemic identified areas and whoever is planning to visit. The general guidance would be to be informed on hygiene measures and sanitation to prevent infection, including drinking bottled water, washing food with chlorinated water before ingestion, washing hands regularly, cooking food properly, and avoiding seafood consumption [21].

Cholera is easily contagious and can cause life-threatening secretory diarrhoea characterised by frequent, voluminous watery stools, often accompanied by vomiting, resulting in hypovolemic shock and acidosis [11-20].

Throughout recorded history, the world has experienced seven pandemics of cholera. The first six are believed to have been caused by the O1 serotype under its classical biotype, whereas the seventh cholera pandemic is believed to be caused by its El-Tor biotype [5-7]. From June to December 2015, Baghdad, Iraq, suffered a Cholera epidemic. The second main hospital in Baghdad, Al-Yarmouk Teaching Hospital (AYTH), close to the epidemic's origin, reflected the evolution of the episode.

This study aims to evaluate the causal strain of the cholera epidemic in Baghdad over 2015 and reflect on the sociodemographic distribution.

2. Methods

A cross-sectional study was conducted during the epidemic period of 1st June 2015 to 1st December 2015. The study population included adult patients admitted to the emergency department in AYTH symptomatic with acute diarrhoea and later diagnosed with cholera. The Central Public Health Laboratory processed both clinical and laboratory investigations.

Patients were assessed by emergency department clinicians and performed the essential clinical exam, including a complete medical history, and requested laboratory investigations. All patients had general stool examination and stool culture with a sensitivity test. All suspected cases were admitted to infectious isolated wards and received treatment. In the case that a stool culture of a patient showed positive results diagnosing cholera infection, all patient’s contacts were asked to attend the hospital to discard cholera infection.

Clinical and residential data were retrieved from hospital records, including laboratory and ward reports that were shared with the Regional Office of the WHO in Iraq to contribute to the official WHO statistics of the epidemic. Patients were classified according to sex and their area of residence. Frequency measures were calculated using Excel 2016.

3. Results

From 1st June 2015 to 1st December 2015, 197 Cholera cases were diagnosed in AYTH. The results positive to Cholera included 91 male patients (46.20%) and 106 females (53.80%). Therefore, not showing a significant difference in the sex distribution of the patients (Table 1). Patients were treated with intravenous fluids and the antibiotic ciprofloxacin. Most patients fully recovered after treatment (98.98%); two died (1.02%). The two patients who died had renal co-morbidities.

Table 1. *The sex distribution of the patients.*

Patients	No.	%
Male	91	46.20%
Female	106	53.80%
Total	197	100%

Stool cultures show that Inaba serotype was the cause of infection in all confirmed cases (Table 2). Most of the patients were from the Baghdad belt zone: 87 patients (44.16% of hospital cases), from which 65 were dependent on agricultural products of neighbouring farmers (Table 3). The initial cases also originated from this area. The second largest group (65 patients, 32.99%) originated from inner areas that adhered to the belt zone. The sum of these neighbouring areas represents 77.15% of the cases.

Table 2. *Type of bacteria distribution of the disease.*

Cholera bacteria type	No.	%
Inaba	197	100%
Ogawa	0	0%

Table 3. *Disease distribution according to residency (inside the hospital only).*

Patients’ areas	No.	%
Baghdad belt zone	87	44.16%
Inner areas adhered to belt zone	65	32.99%
Inner area far from belt zone	29	14.72%
Centre of Baghdad	16	8.12%
Total Patients in Baghdad (sum)	197	100%

4. Discussion

Vibrio cholera caused an outbreak in Iraq during the summer of 2015. Out of 2,810 confirmed *vibrio cholera* cases across Iraq in 2015, 940 cases were in Baghdad [14]. The first cases were diagnosed in Al-Yarmouk Teaching Hospital, the second main hospital in Baghdad. The study hospital results (197 diagnosed patients) constitute 7.01% of all the cases in Iraq. Therefore, the hospital had a good percentage of cases that reflected the status of cholera in Baghdad and Iraq. Additionally, the location of the hospital is close to the area where the epidemic originated [14-16].

Cured cases were predominant, with only two cholera-infection deaths reported in AYTH during this outbreak. This may be due to a successful management protocol for cholera but may also be because there is still no resistance to the antibiotic used (Ciprofloxacin). Nevertheless, we cannot lower our guard, as Cholera is endemic in Iraq. Further studies are needed for the environmental characteristics of the bacteria in order to understand the best ways to prevent and control outbreaks in this area and, if possible, to eradicate them from the country.

According to the available data, early infected patients originated from the Baghdad belt zone (rural areas around

Baghdad low socioeconomic status in majority with moderate education about healthy hygiene). Sixty-five of these early cases were dependent on neighbouring farmers to consume agricultural products that were contaminated with Inaba *Vibrio Cholera*. The outbreak extended afterwards, proximally, and centrally to the inner area of Baghdad city.

The bacteria contaminated the river spreading the disease around Iraq to reach 2,810 patients [1-19]. A likely explanation to why it started at Baghdad belt areas is that the population living in this area depend on farming during the summer season and the usual water supply comes from the river. In the summer of 2015, the river water supply was closed from reaching Baghdad. Consequently, farmers were forced to use well water for drinking and farming. This reflects the need to constantly test the water supply in wells for signs of the *Vibrio Cholera* bacteria contamination. Preventive measures should be enforced to inhibit and control epidemics from these areas, especially during the summer. These measures might include health education for the public, focusing on people at high risk, such as farmers and those living in surrounding areas, supplying safe drinking water and more hygienic toilet facilities. With the difficult political situation in Iraq, public health is not at the best optimum standards, and the health authority should take action to strengthen public health functions across the country. Additionally, based on the WHO guidelines, extra recommendations should be considered for preventing infection, reducing mortality, engaging the community in outbreak management, as well as outbreak surveillance [20].

To reduce mortality rates, health care facilities in places where cholera is endemic should be prepared with enough pre-supplies in advance to cover the first few days in case of an outbreak. These medical supplies would include intravenous fluids and oral rehydration solutions. For this purpose, a health needs assessment should be performed in preparation for the cholera season (Cholera Preparatory Plan). It must include an inventory of the supplies available and needed. Training and refresher courses on cholera management and treatment should also be regularly available to achieve a 90% training goal among the health professionals as recommended by the WHO [20].

For community engagement to limit the spread of disease, focus group discussions among high-risk communities can help identify gaps in knowledge, giving the opportunity to address them promptly. Health education is encouraged with special educational reinforcements before the cholera season. Key messages recommended by the WHO to be given to the community are: (1) Come to the health care facility as soon as possible in case of acute watery diarrhoea; (2) Start drinking oral rehydration solution at home and during travel to the health care facility; (3) Wash your hands before cooking, before eating, and after using the toilet; (4) Cook your own food; and (5) Drink clean water (6) Explain the possible risk of well water contamination with cholera bacteria (20).

Moreover, the availability of soap and chemicals for water treatment should be assessed. In case of insufficient resources, alternative solutions should be provided to ensure basic hygiene practices that limit cholera transmission and therefore be coherent with the educational messages. For surveillance, it is vital to keep accurate records of the number of cases and deaths stratified by area, timeframe, and population sub-groups, in addition to reporting incidence and case-fatality rates. If properly done, that would enable comparison between different regions, periods and factors influencing various outbreaks, thus helping early detection and control.

5. Limitations

The results and information are sourced from only one hospital's patient records. They, in turn, were distributed to the WHO Regional Office in Iraq and the Central Public Health Laboratory in Baghdad that relies on positive stool cultures for cholera. This reporting bias potentially means incidence is underestimated. Many cholera cases in Baghdad are diagnosed outside the working hours of the Central Public Health Laboratory. Collecting large datasets from other sources is required for improved heterogeneity and generalisation. Also, despite including gender and area of residence as sociodemographic variables, including a wider age group (i.e., children) would have strengthened the analysis. It could be an avenue for further research.

6. Conclusion

In Iraq, cholera is an endemic where four outbreaks have been recorded since 2012. Inaba 01 cholera strain has been proven to be an endemic in Baghdad. Our analysis suggests that during the 2015 outbreak, more cases were detected from the belt area of Baghdad while having very few casualties. A possible reason why the epidemic started at Baghdad's belt area is that its inhabitants depend on agriculture watered by a local river. During the summer months, that river water supply was cut from reaching Baghdad. Consequently, farmers had to use well water both for drinking and farming. This echoes the need to test "well" water accurately and regularly. Also, it emphasises the need to ensure the supply of safe drinking water and toilet facilities for high-risk groups such as farmers.

7. Recommendations

Further studies are needed in this field to explorethe amplification of virulence genes, toxin-encoding genes, antibiotic resistance genes, and the use of molecular markers to observe the genomic variability of these V. Cholerae isolates.

Ethics Approval

The study was approved by the Human Research and Ethics Committee, of Anbar university related to Iraq

ministry of higher education and scientific research.

Declaration of Interests

The authors declare that they have no competing interests.

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