Cholera prevention and management in Yemen

Muheng Shan [1, †], Yizhi Zhang [2, *, †]

[1] Guizhou Medical University, China, 550025

[2] Millbrook high school, China, 100010

* Corresponding author. Email: zhangyizhi@stu.gmc.edu.cn

[†]These authors contributed equally.

Abstract. Cholera is an acute, watery diarrheal disease. It can cause people to vomit and diarrhea, dehydration and even death, it is caused by vibrio cholerae. Cholera is very severe in south America and some underdeveloped poor countries, it can be translated by water, food, mosquito, and it can be transmitted through contact with infected people. A country with a low level of education is more vulnerable to cholera because the people don't have an awareness that they must keep their food clean and take some defensive measures when contacting patients. The main means of preventing cholera is to improve water quality and hygiene, which, despite improvements in hygiene and clinical treatment of cholera, still causes about 100,000 deaths a year. In conclusion, even if humans have mastered many ways to control cholera, cholera will still cause a lot of death in a few underdeveloped countries.

Keywords: *Cholera, Disease, Prevention*.

1. Introduction

Cholera is an acute secretory diarrheal infection caused by the bacterium Vibrio cholerae. It is likely to have originated in the Indian sub-continent [1], and become a serious problem for people in many countries for a long time. There have been seven large-scale outbreaks of cholera in history, and the most serious one is the third. From 1852 to 1860, the third cholera epidemic killed a total of 1 million people. Most of the deaths came from Russia, the United States, Japan, Spain, Venezuela, and Brazil.

There are three main part of the cholera's clinical response, the first one is the diarrhea and vomiting period, diarrhea and vomiting period usually starts with sudden diarrhea and then vomiting. Generally, there is no obvious abdominal pain and no sense of urgency. Defecate several times a day, even difficult to count, with a large amount of 2,000 ~ 4,000ml per day, or more than 8, 000ml in severe cases. The excretion of organic acids and nitrogen products in the body is blocked, and patients often have the initial symptoms of acidosis and uremia. Many electrolytes such as sodium and potassium in the blood were lost, and the patient had systemic electrolyte disorder. The second part is the dehydration period, and in severe cases, the eye socket of the patient is deep, the voice is hoarse, the skin is dry and wrinkled, the elasticity disappears, the abdomen is sunken in a boat shape, the lips and tongue are dry, and the patient might feel thirsty. The last part is the recovering period, in this period, some of the patient (mainly child), may occur a febrile reaction, and the body temperature rises to 38℃ ~ 39℃, which generally subsides after 1 ~ 3 days.

People are facing some main problems when they are dealing with the cholera, and one of them is those who have not received a good education in underdeveloped countries because they do not know how to protect themselves under the epidemic, and there are too many of them, it is hard to educate them or teach them the measure to protect themselves.

This paper researched the prevention of Cholera and the mechanism of this disease.

2. Water, Sanitation, and Hygiene

Cholera endemic was considered to happen with low-quality water, sanitation and hygiene (WASH) situation. The use of water sources that have not been manipulated, water that has not been

treated, transporting and storing water irresponsibly, defecation in the wild, hygienic circumstances that haven't been enhanced, low hygiene condition and sanitation facility that is shared are linked to an increased risk of cholera respectively [2-8]. Water source protection was regarded as a critical measure against contamination including piped water, boreholes, springs with protection, and rains. So it is water, which can be treated by boiling, filtering, or chlorine treatment. The use of clean toilets and unshared toilets/latrines by household members only can enhance sanitation for the population. Regardless of intervention or observational studies, investigations established and examined the efficacy of WASH interventions in cholera prevention [9; 10], for all that people in Yemen had low awareness of WASH issues (Figure 1). Al-Sakkaf's research showed that the majority of respondents (97.9%) claimed to have heard of cholera, with 0.5% mentioning five causes and 4.3% mentioning five cholera prevention strategies and only 15.2% cited the usage of safe water and 1.1% mentioned vaccines as a strategy to avoid cholera, even though less than half of the respondents had an overall high knowledge score in Yemen [11].

The fecal-oral route of undercooked food and infected water is the main pathway of cholera transmission attributed to inadequate hygiene, Yemen has poor sewerage and excrement disposal however. Improved water and sanitation services, as well as general sanitation, have proven to be effective in controlling and eradicating cholera in many nations [12]. Existing preventative and control efforts in Nigeria are multi-sectoral. Epidemic Preparedness and Response (EPR) initiatives, such as case registration, public health interventions focusing on personal cleanliness and water purification [13]. Additionally, the availability of good quality sanitation increased from 49% in 1990 to 63% in 2015, while access to adequate sanitation in remote regions increased from 6% to 28% during the same period. Meanwhile, in urban areas, access to piped water increased from 47% in 1990 to 54% in 2015, and in rural areas, it increased from 6% in 1990 to 16% [14]. Current international guidelines show that case-centered methods and household transmission should be prioritized in interventions to successfully prevent cholera and react to outbreaks [15]. Yemen's local government may learn a lot from this.

3. Oral Cholera Vaccines

The current knowledge of cholera immune protection, which is based on local intestine immunity, has resulted in the development of safe and effective orally given cholera vaccines. The evidence suggests that intestinal mucosal immunization is the foundation for immunological protection from cholera and that oral vaccination is the most effective way to induce this immune activity and contribute to the creation of contemporary cholera vaccines [16]. It is critical to utilize oral cholera immunization to protect persons who are at risk. Dukoral, Sanchol, and Euvichol are three OCVs that have been prequalified by the WHO. OCVs prevent cholera in several age cohorts with excellent efficacy and effectiveness and minimum adverse effects, according to studies [17; 18]. Furthermore, because OCVs may confer herd immunity to unprotected people, mass vaccination efforts should be promoted in so-called "hotspots" such as Yemen. Shanchol was examined solely versus in combination with accompanying WASH measures in a recent large-scale, cluster-randomized community efficacy study in Dhaka, Bangladesh, and the findings confirmed no extra prevention against cholera by WASH initiatives, but this could have indicated the not ideal adoption of WASH interventions[19]. Nonetheless, it demonstrated that vaccination is critical in areas where people are at risk because of a lack of clean water and sanitation.

Figure 1. A child receives an oral cholera vaccine in Democratic Republic of the Congo, 2021[20].

4. International Facilities and Funding

Yemen has inadequate medical facilities and an incomplete water supply system, in addition has been suffering from political conflict, and is considered by the United Nations to be the world's most catastrophic humanitarian disaster[21]. Since 2013, WHO has been building a worldwide stockpile of OCV for use in epidemics and endemics, as well as humanitarian crises. WHO, United Nations Childers's Fund (UNICEF), the International Rescue Committee (IRC) and the International Committee of the Red Cross (ICRC) have all provided Yemen with health facilities, cholera treatment centers, cholera kits, beds, safe water, drugs, oral rehydration solutions (ORS), intravenous infusion and diarrhea kits, intravenous infusion, oral rehydration salts, antibiotics and chlorine tablets[22]. And UNICEF is establishing WASH systems in Yemen to help reduce the spread of cholera by providing access to safe drinking water. In 2018, almost 5 million individuals received access to clean drinking water, and around one million people in cholera-prone regions acquired access to home water treatment and disinfection. UNICEF WASH monitors water quality and provides chlorination, power, and fuel, among other services. It also backs municipal water management in 2019 to ensure continued access to clean drinking water. While far from sufficient, they have significantly alleviated Yemen's burden.

5. Local government management

To deal with cholera, local governments in cholera endemic areas need to take some management, the first management would be to raise people’s awareness of WASH and OCVs, the full name of wash is Water, Sanitation and Hygiene for All and is mostly about the water sanitation, and OCV is “Oral cholera vaccination”. According to Yemen’s condition, the main transmission route of cholera bacteria in Yemen is the river. Most people in Yemen have not received a good education because Yemen is not a very rich country, which leads to their lack of understanding of health and safety and drinking water safety. Most of the people in Yemen will drink the water directly from the river, by telling the raised people’s awareness of Water, Sanitation and Hygiene for All can help them protect themselves from the unclean water, and the oral cholera vaccination.

An oral cholera vaccination (OCV) campaign was carried out in Somalia, the first time that the Ministry of Health introduced and used an exogenous cholera virus in cholera prevention and control management. Two doses of OPV were provided to persons over one year of age in high-risk areas, with coverage of 95.5% in all target areas. After gathering a lot of information from those oral cholera vaccination events, researchers find out that the oral cholera vaccination help the patient in many ways, and the succeed possibility are high, in short, although there would be some challenges, oral cholera vaccination can help people to defend cholera under a severe condition [23].

6. Challenges

The challenges that Yemen are facing are also crucial, those challenges including geographical location and inadequate resource, Covid-19, poor management, and civil unrests. Those problems were mainly caused because Yemen is a developing country, and it is not a rich country, and this is the massages about Yemen's healthcare financing. Yemen's total annual health expenditure (the) is $40 per capita, one of the lowest in the world. This study analyzed the preconditions and options for the implementation of basic social health protection in Yemen. Out of pocket accounts for 55% of total revenue, and cost-sharing exemption schemes are not well managed. It is unfair to allocate resources, because about 30% of the funds are allocated to a small number of patients for overseas treatment, mainly from wealthy families. To fight against the absence of social health protection, a series of small-scale and usually informal solidarity plans have been developed, and some public or private companies have set up health benefit plans for their employees [24]. According to the information above, the financial support is causing those challenges in Yemen's cholera dealing. The second challenge is Covid-19, is making this problem bigger than before, Covid-19, the government itself cannot provide too much financial support for the people. The infection of Covid-19 will lead to more people's lack of money for treatment. The following effective information can prove that the people and government of Yemen are powerless to deal with various crises and the invasion of the Covid-19. Yemen has been facing a lot of destruction caused by its devastating civil war and is now having to deal with the spread of Covid-19. Even before the spread of coronavirus disease in 2019, the Yemen people will have to face many problems by themselves, such as hunger, war, infection, and lack of equipment. In short, this is a humanitarian issue. Only about half of hospitals and medical facilities are fully operational, but that is not enough. Health care personnel and facilities don't have the necessary equipment and financial support.

7. Conclusion

Cholera as an acute fatal disease has caused millions of deaths that prevention seems inevitable. While the treatment of cholera, such as oral rehydration therapy, antibiotics/antimicrobials, probiotics and phage therapy is also important, protecting individuals from infection is not only avoiding suffers but lower medical burden. This review identified various factors that contribute to cholera, including water, sanitation, and the use of vaccines for prevention and herd immunity. Yemen is the poorest country in the Middle East. Cholera prevention has been hampered by a lack of medical resources, a lack of water supply infrastructure, sewage treatment systems, and even conflict. International groups have stepped in to assist Yemen's citizens in overcoming their hardships. The local government should also be proactive in responding to the outbreak, raising public awareness of cholera-related issues, and providing effective supervision. Even though cholera prevention in Yemen is difficult, international organizations and local governments should act. This is a never-ending fight, and further efforts will be required.

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