# DEHYDRATING DIARRHOEA IN CHILDREN DUE TO VIBRIO CHOLERAE

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## ABSTRACT

***Objective:*** A descriptive study was carried out to determine the causative organism of diarrhea, it's possible source and the clinical outcome after therapy.

***Patients and Methods:*** Fifteen children were admitted with H/o acute onset of watery diarrhea. Stool samples were submitted to look for motility of the organisms and cultures.

***Results:*** Stools in 8 patients revealed the growth of Vibrio cholerae 01 biotype El Tor serotype Ogawa. All the isolates were sensitive to Doxycycline, Ciprofloxacin and resistant to Cotrimoxazole, Chloramphenicol, Nalidixic acid. Three of the isolates were resistant to Ampicillin. Cholera is endemic in Pakistan with the propensity to cause epidemics especially in summer season.

***Conclusion:*** Adequately chlorinated water supply and improvement in public and personal hygiene can go a long way in preventing large epidemics of Cholera.

**Keywords:** Vibrio cholerae 01 El Tor, dehydrating diarrhea

## INTRODUCTION

Cholera is a severe dehydrating disease feared both, by clinicians as well as Epidemiologists. This is due to it's propensity to cause epidemics with Pandemic potential and its ability to remain endemic in all affected areas [1]. The causative organism of cholera, Vibrio cholerae is part of the normal flora of aquatic environment. It is often associated with algal blooms (planktons), which are influenced by the temperature of the water. Human beings are also one of the reservoirs of the pathogenic form of Vibrio cholerae [2].

Vibrio cholerae is a gram negative, curved, bacillus that shares common characteristics with the family enterobacteriaceae. Intestinal infection with the organism results in the loss of large volumes of water in stools leading to severe and rapidly progressing dehydration and shock. Without adequate and appropriate rehydration therapy, cholera kills about half the affected individuals [3].

Cholera toxin, a potent stimulator of adenyl cyclase causes the intestines to secrete watery fluid rich in sodium, bicarbonate and potassium, in volumes far exceeding the intestinal absorptive capacity [4]. Appropriate use of therapy for dehydrating diarrhea and the concomitant use of antibiotics has reduced the mortality rate by an estimated 3 million per year compared with 20 years ago [5].

Like other Asian countries cholera continues to be endemic in Pakistan with propensity to cause outbreaks especially in summer season.

In August 2003, 15 children were admitted with H/o acute onset of watery diarrhea. The purpose of this study was to determine the causative organism of diarrhea, its possible source and the clinical outcome after therapy

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## PATIENTS AND METHODS

Fifteen children between ages 2-12 years were admitted at C.M.H Pannu Aqil from 10th to 25th August 2003. At the time of admission detailed history was obtained mentioning the number of stools passed per day, H/o fever, pain abdomen and vomiting. Thorough clinical examination was carried out to find out the degree of dehydration. Stool samples were collected and their consistency noted.

### Inclusion Criteria

Children aged 2-12 years, having watery diarrhea and moderate to severe dehydration, with or without vomiting.

### Exclusion Criteria

Patients having diarrhea but the presence of blood or mucus in stools with mild or no dehydration.

Hanging drop method was done to look for the motility of the organism in stool samples. Cultures were done on MacConkey agar, SS agar, TCBS (thiosulphate citrate bile salt sucrose) agar and alkaline peptone water and incubated at 37 C. Subcultures from alkaline peptone water were done on TCBS agar. The growths obtained on these media were studied for morphological characteristics. The oxidase positive sucrose fermenting colonies on TCBS and non-lactose fermenting colonies on Mac Conkey agar were further studied for biochemical profiles using QTS-24(quick test system) identification system for Gram negative bacilli based on 24 biochemical reactions (Defence Science and Technology Organization, Karachi). The isolates identified as Vibrio cholerae were subjected to typing for identification of the serotype of the organism. Specific antisera (Sanofi Diagnostic Pasteur, France) were used for this purpose. The susceptibility of the isolate was tested by modified Kirby and Bauer disc diffusion technique on Mueller Hinton agar(Mast diagnostics, Mast group limited, UK).Various antibiotic discs (Oxoid limited,UK) used were Ampicillin 10ug, Cotrimoxazole 25ug, Ciprofloxacin 5ug, Doxycycline 30ug , Chloramphenicol 30 ug, Nalidixic acid 30ug. Blood glucose, urea, creatinine and electrolytes were done on the day of admission and then 24 hrs after starting the rehydration therapy. Referring to table assessed degree of dehydration.

The patients were rehydrated in two phases, rehydration phase during which Ringer's lactate was given and lasted for 2-4 hrs and the maintenance phase when ongoing losses were replaced by oral route. This phase lasted until normal hydration status was achieved.

## RESULTS

A total of 15 children who presented with watery diarrhea, having some dehydration to severe dehydration during the month of August 2003 were included. Out of these, stool cultures of 8 patients revealed V. cholerae 01 El Tor, serotype Ogawa. All the isolates were sensitive to Doxycycline, Ciprofloxacin and resistant to Cotrimoxazole, Chloramphenicol and Nalidixic acid. Five were sensitive and three were resistant to ampicillin. Five out of 7 who failed to reveal any growth on stool culture gave a history of having taken antibiotics before reporting to the hospital. These patients were included in the group as they also presented with typical rice water stools and moderate to severe dehydration. Patients presented with H/O watery loose motions of 1-3 days duration. Male to female ratio was 7:8 with age range of 2-12 years, mean age was 7 years (table-2).

Ciprofloxacin 5mg/kg IV was given 12 hourly for 1 day and then shifted to oral ciprofloxacin 10 mg/kg for 2 days. In two patients who were severely dehydrated serum urea was raised upto 7.5 mmol/L and serum potassium was found to be below normal. These were corrected when the normal hydration status was achieved. None of our patients developed any serious complication and no death occurred.

## DISCUSSION

Like other infectious diseases cholera is endemic in Pakistan. Due to lack of clean drinking water supply to the population, outbreaks of cholera are likely to occur from time to time especially in summer. This not only puts large population at risk but also imposes significant financial burden on our already impoverished economy.

There have been 6 pandemics in the past with the 7th pandemic continuing. The classic biotype was responsible for the first six pandemics while the biotype El Tor is responsible for the current pandemic [6]. The classic biotype is confined to the south of Bangladesh. Vibrio cholerae 0139 emerged as the major etiologic agent of cholera in Dhaka in December 1992 [7]. In India several outbreaks of cholera by V.cholerae 0139 have been documented [8,9]. The initial rapid emergence and predominance of V. cholerae 0139 was considered possibly to herald the start of the eighth pandemic of cholera [5]. However just after a year the prevalence of V.cholerae 0139 decreased dramatically with V.cholerae 01 resuming the role of dominant cholera strain. The vibrio responsible for the 7th pandemic now in progress is known as Vibrio cholerae 01, biotype Eltor [10].

The management of cholera requires prompt institution of fluid replacement as loss of large volumes of water, dehydration and death may occur in hours if rehydration therapy is not started promptly. The darting motility of V.cholerae can easily be observed by dark field microscopy to make a rapid diagnosis. The use of specific antisera against the serotype blocks the movement of these vibrios and allows confirmation of the diagnosis [11,12]. But definitive diagnosis still requires cultural isolation of the bacteria. The isolation and confirmation however may take several days. Various tests for serologic diagnosis of cholera are also available which detect vibrocidal antibodies and cholera toxin antibody titers by Enzyme immunoassay. Rapid antibody tests have been evaluated for both the 01 and 0139 serotypes and have shown sensitivity and specificity of 100% and 97% respectively [13,14].

**Table-1: Clinical findings according to degree of dehydration.**

| Clinical finding | Some dehydration | Severe Dehydration |
|---|---|---|
| Radial Pulse | Rapid and weak | Very rapid Impalpable |
| Skin elasticity | Retracts slowly | Retracts very Slowly |
| Eyes | Sunken | Very sunken |
| Urine output | Decreased | Oliguria |

**Table-2: Assessment of the degree of dehydration in children.**

| Degree of dehydration | Number of Patients |
|---|---|
| Some dehydration | 13 |
| Severe | 2 |

**Table-3: Sensitivity pattern of vibrio cholerate 01 isolates.**

| Antibiotic | Sensitive | Resistant |
|---|---|---|
| Ampicillin (10ug) | 5 | 3 |
| Cotrimoxazole (25ug) | Nil | 8 |
| Chloramphenicol (10ug) | Nil | 8 |
| Ciprofloxacin (5ug) | 8 | Nil |
| Nalidixic acid (30ug) | Nil | 8 |

In most of our peripheral hospital laboratories, however, even the facility for dark field microscopy and culture of the microorganisms is not available. In these situations a provisional diagnosis of cholera can be made by examination of a film of faeces for V. cholerae motility under light microscope provided expert laboratory staff is available [15].

Cholera is spread mainly by contaminated water and food. Contamination of the public water supply may result in large epidemics, which may be prevented by adequate chlorination of the drinking water [16]. The patients in our study belonged to the community where water is supplied through overhead tanks. For drinking however, people get water from the local filtration plants installed by various units. Presumptive coliform counts on water samples collected at multiple sites as well as from these local plants did not reveal any

evidence of fecal contamination. So a contaminated drinking water supply probably was not the source of infection in these patients. Moreover contaminated water source would have caused a large epidemic of cholera. Contamination of food or drinks prepared locally by a carrier could possibly have been responsible for this localized outbreak as human beings are one of the reservoirs of the pathogenic form of Vibrio cholerae [2,17]. The disease in our study showed endemic pattern where children 2-15 yrs of age are more commonly affected, aquatic environment and asymptomatic people are the reservoir and has multiple modes of transmission e.g water, food and fecal-oral.

Khazaei et al mention a study of 3,594 patients with watery diarrhea out of which 362 samples grew V. cholerae. He mentions that the majority of the patients belonged to poor community with limited access to clean water and health care facilities. This is understandable as all cases of diarrhea with infective etiology occur due to a breach in sanitation. The patients in our study belonged to poor community but had access to clean water and health care facility. Probably that prevented the spread of the disease to other people which otherwise could have resulted in an epidemic [18].

In a study carried out in Mozambique mass immunization of the population with whole cell killed oral cholera vaccine (rbs-wc) has been shown to give 78% protection against cholera. However the cost involved and the problem of access to the remote rural population in our community makes vaccination a less suitable option. Instead the funds should be allocated to the more urgently needed clean drinking water and sanitation [19].

Various antimicrobials are recommended for the treatment of cholera, e.g Tetracycline, Doxycycline, Furazolidone, Cotrimoxazole, Norfloxacin and Ciprofloxacin. Tetracycline and Doxycycline cannot be given to children as they are damaging to the cartilage and bones in growing children. Cotrimoxazole and Furazolidone are commonly advocated for the treatment of cholera, however V.Cholerae has been found to be uniformly resistant to these antimicrobials [20]. Resistace to Chloramphenicol and Ampicillin is also high so these also cannot be prescribed empirically. Ciprofloxacin hence was given intravenously for first 24 hours as the patients had poor oral tolerance, which later was switched to oral therapy for 2 days. Quinolones are not routinely recommended for use in children, however they can be used when the benefit of quinolones outweighs the short-term risk of reversible joint toxicity [21,22].

Acute renal failure due to hypovolemia is the most severe complication of cholera. Hypoglycemia, seizures, fever and mental alteration are more common in children. All of our patients however recovered completely and no complication occurred.

When cholera appears in a community it is essential to ensure three things: hygienic disposal of human feces, an adequate supply of safe drinking water and good food hygiene. This includes not only cooking food thoroughly but preventing cooked foods from being contaminated by contact with raw food including water and ice, contaminated surfaces and flies. Washing hands thoroughly before preparing food or drinking water is equally important. When outbreak of cholera does occur prompt and adequate fluid replacement therapy with appropriate antibiotics ensure a speedy recovery and fewer complications. Vigilance on part of the health authorities to supply adequately chlorinated/treated water to the public and measures to identify the source are important steps to stop the outbreak develop into a large epidemic.

## CONCLUSION

This study shows that Vibrio cholerae was the causative organism of watery

diarrhea in our patients, which is known to be spread by fecal-oral route. The exact source of infection, however, could not be determined as the organism has multiple modes of transmission. Many complications are known to be associated with cholera if treatment is delayed. All of our patients, however, recovered completely.

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