Cholera

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Introduction

- A serious acute diarrhoeal disease caused by *Vibrio cholerae* 01 (Classical or El Tor) and O139.
- It is characterized by sudden onset, profuse, effortless watery stools, vomiting, rapid dehydration, muscular cramps, acidosis and circulatory collapse.
- Fatality rates in untreated cases may exceed 30 - 40 per cent.
- Inapparent and wholly asymptomatic infections are many times more frequent than clinically recognized cases.

History

- In 18th Century,

- John Snow diagnosed a cholera outbreak in London city by pure epidemiological observation and analysis.
  - He discovered that a handpump was responsible for the cholera outbreak and controlled the said outbreak by closure of that pump and water supply.

- He succeeded in the desired public health action long before the causative agent of cholera was discovered.

- Cholera has been endemic in the Ganges Delta since time immemorial.
- There were annual epidemics in West Bengal and Bangladesh.
- From 1817 to 1926, the disease has spread worldwide resulting in six pandemics.
- Six subsequent pandemics killed millions of people across all continents.
- The seventh pandemic started in South Asia in 1961, and reached Africa in 1971 and the Americas in 1991.

Vibrio cholera strains

- Two serogroups of *V. cholerae* – O1 and O139 – cause outbreaks.
  - *V. cholerae* O1 causes the majority of outbreaks, while O139 – first identified in Bangladesh in 1992 – is confined to South-East Asia.
  - Non-O1 and non-O139 *V. cholerae* can cause mild diarrhoea but do not generate epidemics.

- New variant strains (El Tor) have been detected in several parts of Asia and Africa.
  - Observations suggest that these strains cause more severe cholera with higher case fatality rates.

- Careful epidemiological monitoring of circulating strains is recommended.

Magnitude of Problem

- Estimated: 1.4 to 4.3 million cases every year, and 28 000 to 142 000 deaths per year worldwide due to cholera.
- Reported (to WHO): 129 064 cases were notified from 47 countries, including 2102 deaths during 2013.
- The discrepancy between figures is due to the fact that many cases are not recorded for due to:
  - limitations in surveillance systems and
  - fear of trade and travel sanctions.

INDIA:

- Since 1964, following introduction of Cholera El Tor:
  - "Home" of Cholera i.e. West Bengal lost its reputation
  - Non-endemic areas become endemic foci
  - Classical severe epidemics with high mortality become uncommon.
  - Explosive outbreaks following fairs and festivals are now rare.

- India: about 1,127 cases (Gujrat, Maharashtra, Karnataka, TN & WB) and 5 deaths reported in 2013.

Epidemiological Features

- Epidemic, endemic and pandemic disease
- Depends upon:
  - characteristics of agent and
  - characteristics of the system (environment).

- Epidemics of cholera:

➢ Abrupt onset, spread fast, peak, subsides gradually.

➢ Self limiting: Acquisition of temporary immunity and occurrence of sub clinical cases.

➢ Force of infection: through water and through contacts.

Epidemiologically, cholera due to El Tor biotype differs from classical cholera. In El Tor :

- There is a higher incidence of mild and asymptomatic infection.
  - This implies that the characteristic picture of rice-water stools and other signs of classical cholera may not be seen often.
- There are fewer secondary cases in the affected families
- Occurrence of chronic carriers are common
- El Tor vibrios survive longer in the extra-intestinal environment and hence epidemics continue longer
  - They are more resistant than classical cholera vibrios.

Epidemiological determinants

Agent :

- *Vibrio cholerae* was first isolated in 1883 by Koch from the stools of patients with cholera.
- a Gram - negative, aerobic, comma - shaped rod.
- The antigenic classification of vibrios depends on the specific somatic (O) antigens.
- The flagellar antigen (H) is non specific and common to all.

- Ogawa, Inaba and Hikojima:
  - Both classical *V. cholerae* and biotype El tor have been divided into 3 serotypes.
  - Based on the O antigenic components.

Resistance :

- *V. cholerae* 01 is killed by:
  - Heating at 56°C within 30 mins
  - Coal-tar disinfectants i.e. Cresol, and Bleaching powder.
  - Drying and sunshine for a few hours.
  - Commercially prepared acidic (pH 4.5 or less) or dried foods are without risk.
  - Gamma irradiation and temperatures above 70 degrees Celsius.

- It can survive on a variety of foodstuffs for up to five days at ambient temperature and up to 10 days at 5 - 10 degrees Celsius.
- The organism can also survive freezing.
- Low temperatures, however, limit proliferation of the organism and thus may prevent the level of contamination from reaching an infective dose.

Toxin production :

- Vibrios multiply in the lumen of small intestine
- Produce enterotoxins which act on adenyl cyclase - cyclic AMP system of mucosal cells and produce diarrhoea.

Reservoir of infection :

- Human only, either a case or a carrier.
- Case: Important are mild and asymptomatic cases
  - The ratio of severe cases to mild or inapparent infections has been shown to be about 1 : 5 for classical cholera and 1 : 25 to 1 : 100 for El Tor cholera.
- Carrier: Chronic carriers are rare.
  - Types: incubatory carriers, convalescent carriers, healthy carriers and contact carriers.
  - Duration of carrier period is short, about 4 or 5 days.

Infective material :

- Stools and vomit of cases and carriers.
- Carriers excrete fewer vibrios as compared to cases.

Incubation period:

- Short, 2 hours to 5 days, but commonly 1 - 2 days.

Period of communicability :

- A case of cholera is infectious for a period of 7 to 10 days.
- Convalescent carriers are infectious for 2 - 3 weeks.
- Chronic carrier state may last from one month to 10 years or more.

Host factors

- **Age:**
  - All ages are affected.
  - In endemic areas, children are more affected.
- **Sex:**
  - Both sexes are affected.
- **Population mobility:**
  - pilgrimages, fairs, festivals
- **Economic status:**
  - lower SES, poor hygiene
- **Immunity:**
  - Immunity to reinfection, but duration and degree of immunity not known

- Gastric acidity: an effective barrier.

Environmental factors

- Contaminated water and food are the most important environmental factors in the causation of cholera.
- Flies may carry *V. cholerae* but are not vectors of proven importance.
- Social factors responsible for the endemicity of the disease include

➢ poor literacy,

➢ poor personal hygiene,

➢ poor living standards and

➢ unhealthy habits in relation to water and food.

Mode of Transmission

- Most important mode of transmission is through **faecally contaminated water**.
- Disease may spread through food contaminated by food handlers and flies.
- **Fruits and vegetables washed with contaminated water** may transmit the infection.
- **Person to person contact** particularly in overcrowded dwellings without sanitary facilities is very important due to careless handling of human excreta under such conditions.

Clinical features

- The severity of cholera is dependent on the rapidity and duration of fluid loss.
- A typical case of cholera shows 3 stages :

1. **Stage of evacuation**
2. **Stage of collapse**
3. **Stage of recovery**

- **Stage of Evacuation**:

➢ Abrupt onset with profuse, painless, watery (rice water) diarrhoea followed by vomiting.

- **Stage of Collapse**:

➢ The patient soon collapse because of dehydration.

➢ The classical signs are: sunken eyes, hollow cheeks, scaphoid abdomen, sub – normal temperature, absent pulse, unrecordable blood pressure, loss of skin elasticity, shallow and quick respiration.

➢ The urinary output decreases and may ultimately cease.

➢ Restless, cramps in legs and abdomen and complains of intense thirst.

➢ Death may occur at this stage, due to dehydration and acidosis resulting from diarrhoea.

- **Stage of Recovery** :

- If death does not occur, the patient begins to show signs of clinical improvement.
- The blood pressure begins to rise, the temperature returns to normal and urine output is re - established.
- If anuria persists, the patient may die of renal failure.
- The classical form of severe cholera occurs in only 5 10 percent of cases.
- In the rest, the disease tends to be mild characterised by diarrhoea with or without vomiting or marked dehydration.
- As a rule, mild cases recover in 1 - 3 days.

Lab diagnosis

- Specimen:
  - Stools
  - Vomitus
  - Water
  - Food samples

Lab methods:

- Direct examination under microscope with dark field illumination
- Culture methods
- Gram stain and motility
- Serological test e.g. Slide agglutination test.
- Recently developed dipsticks (sensitivity and specificity above 92 and 91%, respectively) for the rapid detection of *Vibrio cholerae* serotypes O1 and O139 from rectal swabs has been successfully used to diagnose cholera.

Management

- Quick restoration of body fluids and electrolytes with appropriate and adequate fluids.
- The volume of replacement depends on the degree of dehydration and the rate of fluid loss.
- Antibiotics, often required in the management of severe cases, have been shown to reduce the volume and duration of diarrhoea.
  - Doxycycline, a single dose of 300 mg orally for three days
  - Tetracycline, 500 mg orally QID for three days
  - For children and pregnant women, Erythromycin or Azithromycin.

Prevention & Control

- **Improvement of environmental sanitation** :

➢ Adequately chlorinated and protected water supply,

➢ Proper disposal of night soil/sewage and

➢ Safe food supply.

➢ Health education is important for improvement of personal hygiene.

- **Immunization:**

➢ Whole cell killed vaccine

➢ B-subunit whole cell killed vaccine

➢ CVD 103-HgR live vaccine

Action on occurrence of the disease

- Verification of the diagnosis
- Notification
- Early case finding
- Establishment of treatment centres
- Rehydration therapy
- Adjuncts to therapy (antibiotics)
- Epidemiological investigations
- Sanitation measures
- Chemoprophylaxis
- Vaccination
- Health education

Key points for public education about cholera

- **To prevent cholera:**
- Drink water only from a safe source or water that has been disinfected (boiled or chlorinated)
- Cook food or reheat it thoroughly and eat it while it is still hot.
- Boil milk before drinking.
- Avoid ice creams from unreliable sources
- Avoid uncooked food unless it can be peeled or shelled
- Wash your hands after any contact with excreta and before preparing or eating food
- Dispose off human excreta promptly and safely
- **Remember:**
- With proper treatment cholera is not fatal
- Take patients with suspected cholera immediately to a health worker for treatment
- Give increased quantities of fluids as soon as diarrhoea starts.