

Pakistan's Stance Against Rotavirus-Need for Awareness

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Abstract

Rotavirus is a double stranded RNA virus classified on the basis of VP6 protein and its subgroups are classified on the basis of VP4 and VP7. It is the pathogen responsible for diarrhea and in severe cases mortality of children under the age of 5. Rotavirus is an enteric pathogen infecting mainly small intestine and as it can only be treated symptomatically its infection is handled by body's immune system. The mortality rate in Pakistan due to diarrhea and acute respiratory infections is extremely high (1 child per minute) and even mega city like Karachi cannot safeguard its population from rotavirus in its water supply. Vaccination is the best preventive method for rotavirus. To cope with these problems government has taken an initiative by including rotavirus vaccine in its EPI program all over the country in 2017 and 2018, and is hopeful that this step would be fruitful in reducing child mortality rate in Pakistan.

Keywords: Diarrhea; Malabsorption; GI infections; Microbial pathogenesis

Introduction

The most common pathogen causing diarrhea in young children and infants is Rotavirus, around 95% of children belonging to age group 3 to 5 years are infected by this virus and suffer from diarrhea [1]. On average, globally rotavirus causes around 440,000 deaths per year, but according to another report this number is much higher and goes to around 800,000 mortalities per annum in infants and young children [1]. The ratio of deaths due to diarrhea caused by rotavirus is 1 child in every 293 children but the sorrowful information is that when we move towards developing and specially underdeveloped countries this ratio is devastatingly high and death ratio among children reaches to around 82% [2].

Background and Identification

According to the data collected in a span of 2 years from 1962 to 1964 in England at Fairfield hospital there were two types of diarrheas reported in accordance with seasons, summer and the winter. The pathogen for both were different, but most commonly occurring diarrhea was reported in winter seasons with 80% of cases admitted were of unknown origin [3]. In May 1973 first time by the use of electron microscope a large amount of viral particles were located from the gastrointestinal tract lining of upper villous surface from epithelial cells, these particles were classified as reovirus or orbivirus like particles [4]. The word "Rota" in rotavirus is a Latin word which means (Wheel like) as its appearance was found firstly in electron micrograph [4]. At last in 1973, in Melbourne, Australia after multiple researches and experiments a team of doctors identified that gastroenteritis was caused by rotavirus in infants and young children [3].

Virology

Rotavirus is double-stranded RNA virus and it possesses icosahedral symmetry in its structure [5]. On the basis of genetic and

antigenic properties rotavirus is classified into 8 types from A to H [5,6]. In all of these type of rotaviruses, the most common type which accounts for more than 90% of cases in humans is rotavirus type A [5]. Further sub-classification of rotavirus is done on the basis of serotyping and genotyping [7,8].

Classification

Rota virus belongs to the family Reoviridae [9,10]. It is classified into groups, subgroups and serotype [11]. Groups and subgroups are predominantly based on the genetic variation of a special structural protein or antigen called VP6 [9,11]. The versatility of VP6 classifies groups into 8 species alphabetically from A to H [5,6]. From these eight types, the three initial types i.e. rotavirus type A, type B and type C are known to infect humans and animals both, while the others are restricted to animals only [10,12]. Subgroup's further classification is also based on VP6 protein [11]. Regarding pathogenicity in humans subgroup1 and subgroup2 are identified as the main culprits [13].

Serotyping or serological classification is mainly restricted to group A rotavirus which is based on two different viral proteins which are VP7 and VP4. VP7 is a glycoprotein and VP4 is a spike protein [14-16]. For the classification VP7, which is a glycoprotein, "G" abbreviation is used and for VP4, which is a protein, "P" abbreviation is used and they are called G-type and P-type respectively [17].

Rotavirus Typing

Rota virus typing can be done via traditional and modern methods. ELISA (Enzyme-Linked Immunosorbent Assay) test and RT-PCR (Reverse Transcription Polymerase Chain Reaction) test are considered as traditional methods whereas tests like oligonucleotide microarray hybridization and sequencing are more modern and efficient tests [18].

Pathogenesis

As an enteric pathogen, rotavirus is solely the most common reason for severe life threatening diarrhea in younger children [2,19]. It initially infects mature absorptive villous enterocytes of small intestine

in upper two third region, then after a time period the mature viral particles burst out and now infects enterocytes of lower one third of intestine for replication [1,20]. Although rotavirus is restricted to intestinal mucosa in a immunocompetent patient but both local and systemic inflammation is triggered, and certain studies have shown that intestinal immunity may reduce the severity of infection [1].

Transmission

Orofecal route is the mode of transmission for rotavirus but other modes are also identified like through respiratory secretions, person to person contact [1]. Contaminated water is also a source for its transmission [21]. Multiple children gathering under one roof often leads to the transmission of rotavirus from one child to another, like in daycare centres [22]. Maintaining a good hygienic environment like cleanliness and proper hand washing are factors to prevent the disease but they are not proven to be sufficient enough to control the spread and decrease the number of hospitalizations [22,23].

Symptoms and Clinical Presentation

After getting infected by rotavirus, it takes around to 3 days for symptoms to appear [21]. Mild to severe degree of diarrhea is the major symptom of acute gastroenteritis caused by rotavirus, other symptoms include vomiting, low grade fever, poor appetite, chills, abdominal cramps and abdominal pain but in some cases it may remain asymptomatic [20,22,23]. In clinical settings diarrhea, vomiting, crying with few or no tears decrease urination and dizziness while standing are some common signs to recognize a patient with dehydration [24]. Due to continuous water loss from body, severe dehydration and cardiovascular failure results and it may lead to death but this is rare in developed countries due to availability of better health care services [20].

Diagnosis

Signs and symptoms are the main criteria in clinical settings to diagnose acute gastroenteritis caused by rotavirus [21] for laboratory diagnosis stool samples of patient are sent for ELISA test, in which VP6 group A antigen is detected [24,25]. There is an alternative test known as immunological test in which antibodies against VP6 antigen are used for rotavirus detection [25]. The cases usually appear in winter or early spring [21]. The time period for detecting these antigens in stool varies from 1 week to 1 month depending on the immunity of patient [1].

Treatment and Prevention

The treatment of rotavirus infection is based on type of diarrhea. Diarrhea may be categorized into three types from mild to severe based on the number of loose stools per day. Mild diarrhea is usually treated at home while on the other hand moderate to severe diarrhea needs medical supervision [2]. Young children and infants with severe diarrhea need intense care at the hospital [26]. There is no specific treatment for rotavirus infection rather the treatment is symptomatic and to maintain fluid balance of body for which large amount of rehydration fluid is prescribed and patient's immunity deals with infection in most cases [21]. Researches have shown that rehydration via oral or NG method is safe and efficient in patients dealing with moderate diarrhea [27]. Providing health education to mothers in villages about the need of early rehydration of a child with diarrhea has

also proven to be a major step in reducing the mortality of infants and young children in developing countries [3].

Vaccination is the best prophylactic treatment to reduce the cases of gastroenteritis and to reduce the severity of diarrhea in infants and young children [22,23]. There are two vaccines currently available, namely Rotatech and Rotarix and they are administered orally [22]. Rotatech is given at 2nd, 4th and 6th month and Rotarix is given at 2nd and 4th month [26].

Reflection from Pakistan

Pakistan is a developing country and as other developing countries, health issues of children are very important because a single child dies every minute due to diarrhea and acute respiratory infections in Pakistan. There are many factors that results in deaths of children but they are rather preventable like improper health care services, low socio-economic conditions of a house and delayed access to medical services [23]. Pakistan's government has introduced rotavirus vaccine in its EPI schedule to vaccinate children against rotavirus [28]. Vaccine was first introduced by Punjab (Province in Pakistan) government in January 2017, [29] then KPK (Province in Pakistan) government in January 2018 introduced it in its EPI program followed by Sindh (Province in Pakistan) and Balochistan (Province in Pakistan) governments simultaneously in April 2018 [30-32].

Conclusion

Rotavirus is one of the most common reason of mortality and gastroenteritis in children [33] and mortality rate increases when this condition seen in developing countries like Pakistan. Mortality rate in children of Pakistan is around single death per minute due to diarrhea and acute respiratory infections, and it is sorrowful because these deaths occur due to improper health care system [23]. Unavailability of vaccines also causes loss of million innocent lives every year [34]. On the other hand researches have shown that even a mega city of Pakistan like Karachi has not assured 100% safety from rotavirus to its citizens in water supply and rotavirus and other enteric pathogens are detected in water provided to the city [5]. Government of Pakistan is trying to cope this problem by its EPI program in which it has recently introduced rotavirus vaccine in the term 2017 and 2018 [29-32] and good outcomes are predicted by this step to reduce the life loss in Pakistan.

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