

## Overview of Acute Gastroenteritis in Children

Soha Abdulmalik Ashoor<sup>1\*</sup>, Waad Abdullah Aljubairah<sup>2</sup>, Ohoud Ahmed Haddadi<sup>3</sup>, Hadeel Ayman Alrabee<sup>3</sup>, Sulaiman Hamad Althobaiti<sup>4</sup>, Musaad Mohammed Almutairi<sup>4</sup>, Raghad Ali Alghorayed<sup>5</sup>, Khulud Yahya Khati<sup>6</sup>, Abdulhadi Hamdan Alomari<sup>7</sup>, Ibrahim Musaad Aljuraifani<sup>8</sup> and Khulood Zaki Alaidaroos<sup>9</sup>

<sup>1</sup>*Pediatric Consultant Gastroenterology and Nutrition, East Jeddah General Hospital, Jeddah, Saudi Arabia*

<sup>2</sup>*Maternity and Children Hospital Al-Ahsa, Saudi Arabia*

<sup>3</sup>*East Jeddah General Hospital, Jeddah, Saudi Arabia*

<sup>4</sup>*Shaqra University-Shaqra, Saudi Arabia*

<sup>5</sup>*The Hashemite University, Zarqa, Jordan*

<sup>6</sup>*King Abdulaziz Hospital, Jeddah, Saudi Arabia*

<sup>7</sup>*Jordan University of Science and Technology, Irbid, Jordan*

<sup>8</sup>*Unaizah College of Medicine, Unaizah, Saudi Arabia*

<sup>9</sup>*Maternity and Children Hospital, Jeddah, Saudi Arabia*

**\*Corresponding Author:** Soha Abdulmalik Ashoor, Pediatric Consultant Gastroenterology and Nutrition, East Jeddah General Hospital, Jeddah, Saudi Arabia.

**Received:** November 03, 2019; **Published:** November 12, 2019

### Abstract

**Introduction:** Acute gastroenteritis is often considered a benign disease but remains the leading cause of morbidity and mortality in children around the world, mostly in developing countries. While in developed countries, it is one of the common presentations in the emergency department for which need admission to hospital and in general practice. The most frequent and dangerous serious complication is dehydration, which is associated with metabolic acidosis as well as electrolyte disturbances. An appropriate amount of oral and intravenous fluids taken helps in minimizing the risk of dehydration and the adverse outcomes associated with it. Antibiotics, antidiarrheal agents and antiemetics are not recommended regularly since it may be harmful. Prevention is the key to control diseases like gastroenteritis. The recently licensed, highly effective rotavirus vaccines will have a major effect on public health. And as a result of the success of rota virus vaccine Noro virus has become the predominant agent of paediatrics viral gastroenteritis

**Aim of the Study:** The aim of the review is to understand the management of acute gastroenteritis among children.

**Methodology:** The review is comprehensive research of PUBMED since the year 1999 to 2018.

**Conclusion:** With the development of safe, effective oral rehydration solutions as compared to home remedies, which has doubted outcome and the use of intravenous regimens has significantly changed the management of acute gastroenteritis among children. However, oral rehydration therapy is still not popularly utilized in the developing world. The physicians thus can change the situation by becoming familiar with the guidelines for oral rehydration therapy. The patient can be instructed about its appropriate use. With appropriate patient education, the reduction of none recommended medication use and the application of oral rehydration therapy in their clinical practices, family physicians can reduce outpatient morbidity and lessen the inconvenience and costs associated with the emergency department and inpatient treatment of acute gastroenteritis.

**Keywords:** Acute Gastroenteritis; Oral Rehydration Therapy; Antimicrobials; Vaccines

**Epidemiology**

A cute onset of Diarrhea or vomiting, or both, which may be accompanied by fever, anorexia and abdominal pain, is termed as acute gastroenteritis. The passage of excessively liquid stool with increases in the frequency and water consistency is termed as diarrhea.

Annually 3 - 5 billion cases of acute gastroenteritis occur worldwide, leading to 2 million deaths of children under 5 years per year. In the United States, gastroenteritis leads to about 10% of admissions to hospital, 300 deaths in children of or under 5 years of age and more than 1.5 million outpatient visits annually. In Australia with the same age group, about 10,000 hospital admissions, 115,000 general practice consultations occur annually for rotavirus alone and 22,000 visits to emergency departments. In the United Kingdom, 204 consultations out of 1000 consultations of children under 5 years of age, with general practitioners are for gastroenteritis and hospital admission of 7 out of 1000 children per year. Children are often infected but remain asymptomatic and, thus, unwittingly transmit infection [1-3].

**Methodology**

We did a systematic search for Acute Gastroenteritis in Children using PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>). All relevant studies were retrieved and discussed. We only included full articles.

The terms used in the search were: Acute gastroenteritis, oral rehydration therapy, antimicrobials, vaccines.

**Pathophysiology**

The secretion and reabsorption of fluid and electrolytes in the intestinal tract maintain adequate fluid balance in the body. In diarrhea, intestinal fluid output overwhelms the absorptive capacity of the GI tract. The 2 main mechanisms causing acute gastroenteritis are: [4]

1. The release of toxins bind to specific enterocyte receptors, which in turn release the chloride ions into the intestinal lumen, further leading to secretory diarrhea.
2. Damage to the villous brush border present in the intestine, causing malabsorption of intestinal contents and leading to osmotic diarrhea.

But even in the case of States diarrhea, several sodium-coupled solute co-transport mechanisms remain intact; this allows the reabsorption of salt and water efficiently [4].

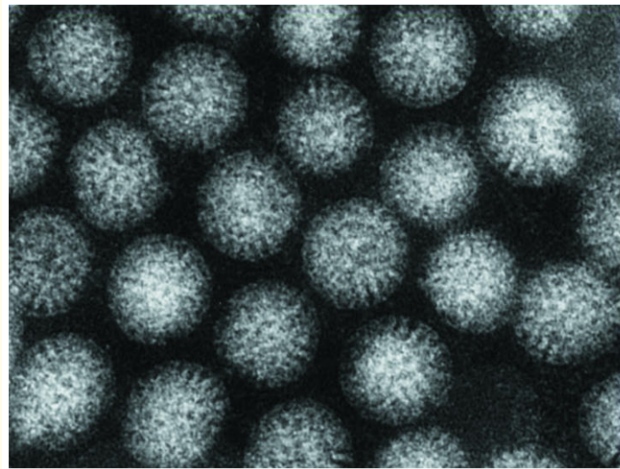
**Causes and Clinical Presentation**

Some common causes of acute gastroenteritis are as follow [6].

<b>Viral (70%)</b>
<ul style="list-style-type: none"> <li>• Rotavirus</li> <li>• Noroviruses</li> <li>• Enteric adenovirus</li> <li>• Enterovirus</li> <li>• Caliciviruses</li> </ul>
<b>Protozoa (&lt;10%)</b>
<ul style="list-style-type: none"> <li>• <i>Cryptosporidium</i></li> <li>• <i>Entamoeba histolytica</i></li> <li>• <i>Giardia lamblia</i></li> </ul>
<b>Bacterial (10 - 20%)</b>
<ul style="list-style-type: none"> <li>• <i>Campylobacter jejuni</i></li> <li>• Non-typhoid <i>salmonella</i></li> <li>• <i>Shigella</i></li> <li>• <i>Yersinia enterocolitica</i></li> <li>• <i>Salmonella typhi</i> and <i>S. paratyphi</i></li> <li>• <i>Vibrio cholerae</i></li> </ul>

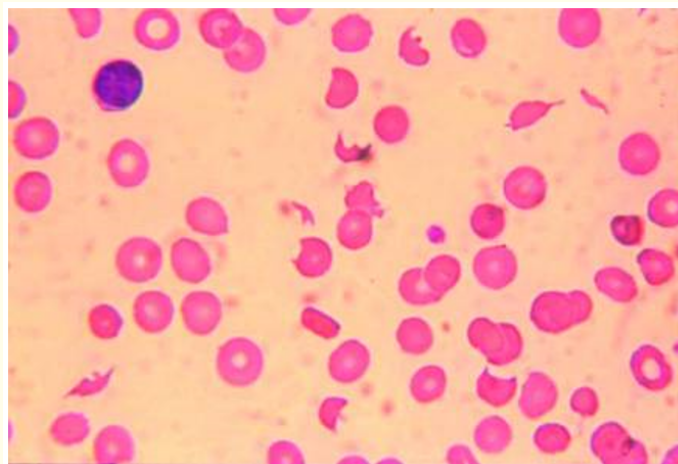
**Table 1:** Common causes of acute gastroenteritis [6].

The most common cause of gastroenteritis is rotaviruses (noroviruses being most common). Viral infections damage enterocytes in the small intestine and which leads to low-grade fever and watery diarrhea without blood. Rotavirus infection is known to be seasonal in temperate climates, with maximum cases in late winter, but in tropics climate, it occurs throughout the year. The strains of rotavirus vary geographically and by seasons within countries. The peak age for infection is found to be 6 months and 2 years and the common mode of spread is by the fecal-oral or respiratory route [5].



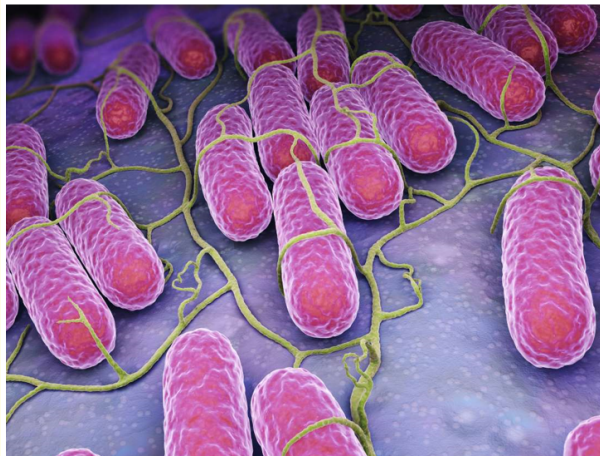
**Figure 1:** Showing rotavirus particle seen under a microscope.

*Campylobacter jejuni* and *Salmonella sp* invade the lining of the small and large intestine and cause inflammation. The bacterial gastroenteritis has symptoms like high fever and even white blood cells and blood in the stool. Infection caused by *Escherichia coli* or *Shigella dysenteriae* leads to hemorrhagic colitis, which may be complicated by hemolytic uremic syndrome, characterized by acute onset of microangiopathic hemolytic anemia, thrombocytopenia, acute renal impairment and involvement of another system [7].



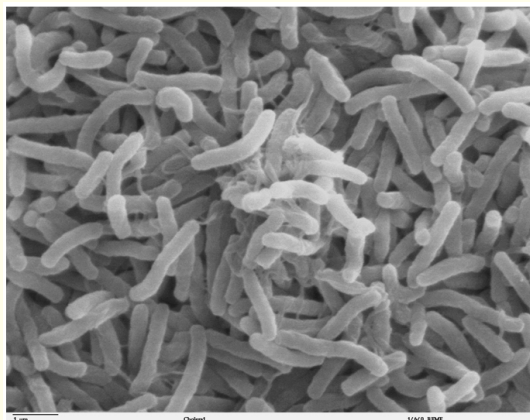
**Figure 2:** Showing peripheral blood film in a patient with hemolytic uremic syndrome, microangiopathic hemolytic anemia, and thrombocytopenia. Fragmented, irregular, and helmet-shaped red blood cells as well as immature platelets [6].

*Salmonella typhi* and *S paratyphi* cause enteric fevers characterized by high swinging fever, diarrhea, CNS involvement such as encephalopathy, leucopenia.



**Figure 3:** *Salmonella typhi* under microscope.

Chloride and water secretion from the small intestine is caused by *Vibrio cholera* toxin but does not damage intestinal mucosa, it results in rice water stools (with high sodium content) [6].



**Figure 4:** *Vibrio cholera* under microscope.

### Diagnosis and laboratory investigation

Diagnosis starts with a detailed history and physical examination, which helps physicians in differentiating gastroenteritis from other diseases causing diarrhea and vomiting, the insight at exact etiology and estimating the degree of dehydration. History includes details about recent contact with people having gastroenteritis, duration, frequency, amount, character of stool. The duration, frequency and quality of vomitus (food content, bile, blood) and the last episode of vomiting. Fluid intake and urine output with any decrease in the frequency of urine and any change in urine color [6].

Abdominal pain, its location, quality, severity and timing of pain. Diarrhea and vomiting are no specific symptoms in young children and the diagnosis of gastroenteritis should be questioned in children with high fever, chills, myalgias, rash, sore throat.

Children with underlying diseases can be at increased risk of complications and referral to a pediatrician should be considered [6].

Physical examination includes general assessment, level of alertness, ill looking appearance, lethargy, Presence or absence of tears or moist mucous membrane, the sunken appearance of eyes., loss of skin turgor Vital signs: heart rate, quality of pulse, respiratory rate, abdominal tenderness, skin rash should be evaluated [6].

### Laboratory investigations

It is mainly done to assess the hydration status, which determined the immediate management of the condition. Most of the children with acute gastroenteritis do not need serum or urine test since it is not very helpful in determining the degree of dehydration. In a study, only serum bicarbonate has statistically positive and negative ratios for detecting dehydration and is also associated with clinical dehydration score out of all urine biomarkers [8,9].

The child with profuse watery diarrhea and increased frequency of vomiting are most at risk. Physicians often overestimate the extent of dehydration. A good indicator to assess the degree of dehydration is documented recent weight lost. The better clinical indicators are prolonged capillary refill, abnormal skin turgor and absent tears in patient with more than 5% dehydration. Serum electrolytes are not routinely required, but it should be measured before and after starting intravenous fluids [8].

Leukocytes count in feces and stool culture can be helpful in children presenting with bloody diarrhea. Stool of children of 12 months of age or more with a recent history of antibiotic use should be tested for *C. difficile* toxins. Children with a history of prolonged watery diarrhea of more than 14 days or recent travel to an endemic area should have stool tested for ova and parasites. And those with presence systemic infection should have a complete workup such as complete blood count (CBC) and blood cultures, urine cultures, chest radiography and/or lumbar puncture is required [8].

### Treatment

#### Fluid therapy

Children with mild dehydration are usually managed at home, but children who cannot be managed at home or those with high risk for complications should be considered for admission. Mild-moderate dehydration in children who cannot tolerate oral fluids should be admitted and observed. Breastfeeding is advised to be continued during acute gastroenteritis and along with an oral rehydration solution if needed [4,10-12].

Ideal oral rehydration solutions is the hypo osmolar ORS because sodium, glucose and so osmolality low that lead to reduced stool volume, decrease vomiting and decrease the need for intravenous fluid.

Most of the children refuse rehydration solutions because they dislike the taste or because it induces vomiting. In this case, where oral intake is inadequate, a fine bore nasogastric tube is used, or the fluids may be given intravenously. Intravenous fluids or enteral (oral or nasogastric) route for fluid therapy are equally effective and safe for mild to moderate dehydration and by this method, rehydration can be achieved in four to six hours usually [13,14].

Severe dehydration is candidate for intravenous fluid resuscitation.

### Antiemetic

Ondansetron (selective serotonin 5-HT<sub>3</sub> antagonist) for children older than 6 months of age with viral gastroenteritis and mild to moderate dehydration with persistent vomiting that interfere with ORS. A single oral dose of ondansetron 0.15 mg/kg reduce progression to the need for intravenous fluid in children with dehydration. Other antiemetic not recommended to be used in acute gastroenteritis because of the side effect and lack of evidence to support their use.

### Probiotic and prebiotic

Are live microbes that have the potential that benefit the host by altering intestinal flora, synthesis antimicrobial substance, stimulate immunity and reduce the duration and severity of diarrhea in acute gastroenteritis [20].

### Vaccines

The Food and Drug Administration (FDA) approved a vaccine RotaTeq for the prevention of rotavirus gastroenteritis in February 2006. The vaccine was endorsed by the American Academy of Pediatrics (AAP) and recommended that the vaccine should be administered in 3-dose series at 2, 4 and 6 months of age. RotaTeq protects against G1, G2, G3 and G4 serotypes and is a pentavalent vaccine that contains 5 live reassortant rotaviruses. The FDA approved another oral vaccine, Rotarix, in April 2008 for the prevention of rotavirus induced gastroenteritis. According to the current AAP, the recommendation Rotarix vaccine should be administered in 2 separate doses to infants at the age of 2 and 4 months. Rotarix protects against the strain G1, G3, G4 and G9, causing rotavirus gastroenteritis [15].

### Antimicrobials

Antibiotics are usually not indicated since most of the cases of gastroenteritis are due to viruses, even when bacterial causes suspected because the majority of gastroenteritis are self-limited and antibiotic may be harmful.

In children who show positive stool assays or high clinical chances for *C. difficile*, in these, the offending antibiotic should be stopped immediately and vancomycin or metronidazole is recommended or both in severe cases. In the first-occurrence of the severe episode, vancomycin is recommended with additionally optional metronidazole IV. In case of the recurring, severe episode, rifaximin should follow vancomycin.

Single-dose azithromycin (20 mg/kg) as first-line therapy for treating pediatric cholera infection. Antibiotic therapy should be given to children presenting with moderate to severe dehydration, especially in resource-constrained settings [16,17].

Antibiotic is always recommended for culture proven *Shigella* (β-lactams) and for immune compromised patient. Amebiasis and giardiasis should be treated by metronidazole or Tinidazole [21].

### Prevention

Rotavirus is the common cause of acute gastroenteritis. Rotavirus is usually spread by means of aerosols, gastroenteritis spread by the fecal-oral route. Young children served uncooked fermented meats, unwashed fruits and salads, undercooked hamburgers and water contaminated by animal feces leads to bacterial gastroenteritis. The environmental sources of gastroenteritis are children's animal farms, swimming pools and beaches. Good hygiene is an important factor in preventing the spread of infection. Few measures, such as careful hand washing, nappy disposal and preparation and storage of food and drinking water, are outlined in WHO's five-step guide to safe food. Maintenance of hygiene is particularly important in institutions, including hospitals where the nosocomial infection is common [6].

The development of two oral rotavirus vaccines [RotaTeq and Rotarix] is a major recent advancement in the prevention of gastroenteritis. The safety and efficacy have been confirmed in recent large-scale trials. RotaTeq derived from live human-bovine and is a pentavalent reassortant vaccine present in 3 doses. Rotarix (is attenuated human (strain G1P) monovalent vaccine present in a 2 dose. Both vaccines



are highly immunogenic and proven to provide cross-protection against common serotypes and effectively decrease in rates of severe gastroenteritis along with the further need for intravenous fluids and hospital admission. Both vaccines are not associated with any serious adverse effects or increased risk of intussusception, which otherwise was evident with Rota Shield, the first licensed vaccine. In this scenario, all communities should be provided free access to rotavirus vaccine because it may significantly reduce the mortality and morbidity in children suffering from acute gastroenteritis [18,19]. Several norovirus vaccine are under clinical trials.

### Conclusion

Acute gastroenteritis is a major cause of mortality and morbidity in children, especially those with poor nutrition, are at increased risk of complications. The cost of the increased rate of hospital admission due to gastroenteritis and comorbidity associated with the electrolyte disturbances is huge load on the community and often goes underestimated. Thus, root causative agent should be diagnosed properly and managed accordingly. The management mostly includes fluid therapy (oral rehydration solution), antimicrobials if required and best prevent through rotavirus vaccines since it is the common cause of acute gastroenteritis among young children.

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**Volume 15 Issue 12 December 2019**

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