

Acute gastroenteritis in children

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Abstract

Acute gastroenteritis is a common problem in children and refers to infections of the gastrointestinal tract caused by viral, bacterial or parasitic pathogens. Most cases are not serious and self-limiting. However, severe complications and a high mortality rate may be associated, with diarrhoea being responsible for up to 2.5 million deaths worldwide in young children each year. Diarrhoea may also contribute to serious morbidity where acute cases become persistent with a significant impact on nutritional status. Various risk factors can be identified, such as malnutrition, young age, immune compromised and increased exposure to pathogens due to poor hygiene and sanitation. Clinical evaluation includes a thorough assessment of the features and degree of dehydration as well as of comorbid conditions. The IMCI guidelines provide valuable protocols for prompt management of acute diarrhoea and dehydration in children, while supplementary zinc, adequate feeding practices and appropriate antibiotic treatment in selected cases contribute further to reduce the duration, severity and mortality of acute diarrhoeal disease in childhood.

Introduction

Acute gastroenteritis refers to infections of the gastrointestinal tract caused by viral, bacterial or parasitic pathogens. The most frequent manifestations are diarrhoea and vomiting, which may also be associated with systemic features such as abdominal pain and fever.¹ It is a common problem in children. Most cases are not serious and are self-limiting. However, severe complications and a high mortality rate may be associated, with diarrhoea being responsible for up to 2.5 million deaths worldwide in young children each year.² Diarrhoea may also contribute to serious morbidity where acute cases become persistent with a significant impact on nutritional status. This article will focus on the most common causes of acute gastroenteritis, risk factors, clinical evaluation, recognition of serious complications like dehydration, and effective management.

Aetiology

In children, acute diarrhoea is almost entirely caused by infections acquired through the faecal-oral route or by ingestion of contaminated food or water. Episodes usually last 5–10 days. Common causes are summarised in Table 1.³

In developed countries viral agents of gastroenteritis are the leading cause of watery diarrhoea in childhood. Rotavirus is known to be the most common pathogen in children worldwide.⁴ Rotaviral gastroenteritis is more severe than other causes

Table 1: Common causes of acute diarrhoea

Infectious
Viral
Rotavirus
Norwalk agent
Enterovirus
Calicivirus
Adenovirus
Astrovirus
Norovirus
Bacterial
<i>Escherichia coli</i>
Shigella
Salmonella
Yersinia
Campylobacter
Clostridium Difficile
Vibrio cholera
Protozoa
Giardia
Cryptosporidium
Entamoeba Histolytica

Adapted from Pediatric Gastrointestinal and Liver Disease, Robert Wyllie and Jeffrey S Hyams, Elsevier 2006³

of gastroenteritis and more often results in dehydration, hospitalisation, shock electrolyte imbalance and death. The

clinical course varies, but 24–48 h of severe vomiting is usually followed by fever, watery diarrhoea for 2–7 days and respiratory symptoms in up to 40% of patients. Current rotavirus vaccines, now included in the vaccination schedule, are effective to reduce the frequency and especially the severity of rotaviral gastroenteritis.⁵

Bacterial pathogens are more common in developing countries where poor sanitation, hygiene and water supply play a role, causing dysentery. In endemic areas cholera is an important pathogen. The most important protozoa causing diarrhoea are *Cryptosporidium* and *Giardia lamblia*.² Ingestion of food containing toxins (e.g. *Staphylococcus aureus*) may cause rapid onset of vomiting and diarrhoea. Due to increased rates of overseas travel, “traveller’s diarrhoea” caused by a range of organisms not normally seen in that environment, is occurring more frequently.⁴

Risk factors

Risks for gastroenteritis include immune deficiency, onset of diarrhoea at less than three months, measles, malnutrition, lack of breastfeeding and environmental contamination with increased exposure to enteropathogens. Malnutrition increases the risk for diarrhoea and associated mortality several-fold, especially so with micronutrient deficiencies: in children with vitamin A deficiency the risk of dying of diarrhoea, measles or malaria is 20–24%, and with zinc deficiency 13–21%. Furthermore cases of persistent diarrhoea (episodes that began acutely but last for at least 14 days) account for 3–20% of all diarrhoeal episodes in children less than five years of age and up to 50% of all diarrhoeal deaths.¹

Clinical evaluation

The child with acute gastroenteritis is evaluated for signs of dehydration and shock. Table II summarises the symptoms associated with the degree of dehydration. Important comorbid conditions like bacteraemia, pneumonia and malnutrition should be excluded. These children, as well as those with immune compromise, require special attention and

aggressive management as they often have a prolonged course with increased morbidity and mortality and are more likely to develop serious complications.

Complications

Without early and appropriate rehydration, complications like dehydration and shock, associated electrolyte abnormalities (hypernatraemia, hyponatraemia, hypokalaemia, hypocalcaemia and hypomagnesaemia), hypoglycaemia, and renal failure may ensue. Haemolytic uraemic syndrome is another serious complication. Central nervous system complications include convulsions and venous sinus thrombosis. These complications can be life threatening and need prompt management.

Diagnosis

The diagnosis of acute gastroenteritis is based on clinical recognition of the disease and rapid identification of complications. Confirmation by appropriate laboratory investigations like stool microscopy, culture and evaluation for viral pathogens will follow. Complications like electrolyte disturbances should be evaluated by appropriate serum electrolyte measurements.

Management

1. IMCI (Integrated Management of Childhood Illness) protocol

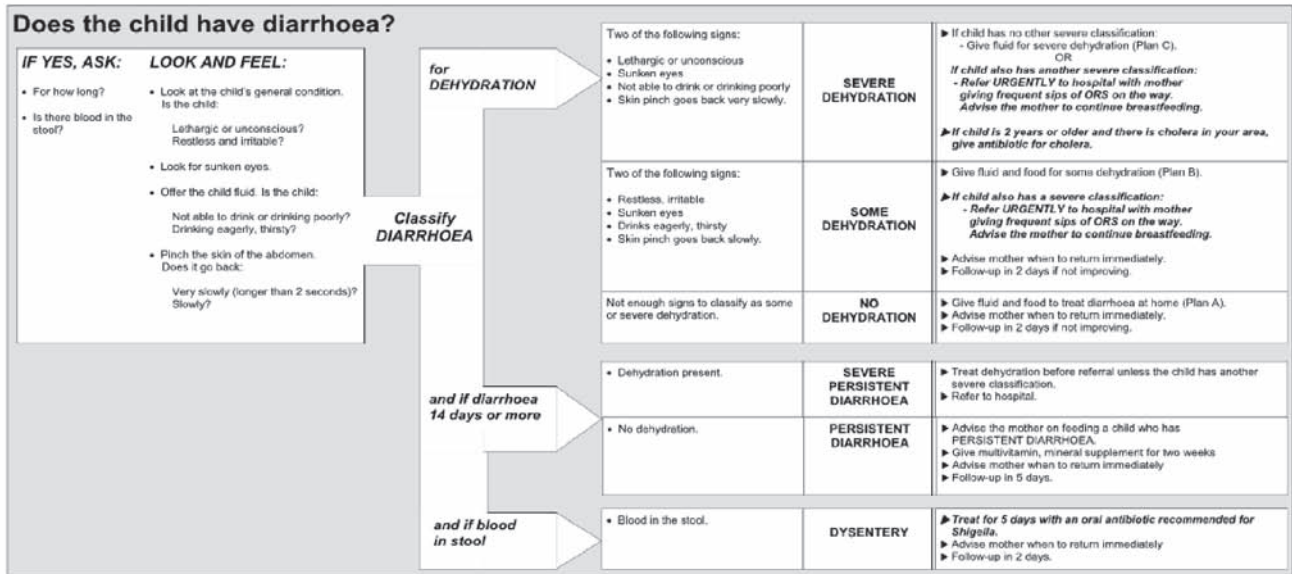
The clinical approach to the diagnosis and management of diarrhoea in developing countries is a critical component of the IMCI programme. Figure 1 summarises the initial approach according to these guidelines, and the different treatment plans A, B and C are delineated in Figures 2 and 3. Recognition of dehydration and the degree thereof with prompt and adequate rehydration is imperative. Management of complications like electrolyte disturbances and maintenance of adequate nutritional status is of further importance.

Table II: Symptoms associated with dehydration

SYMPTOM	MINIMAL OR NO DEHYDRATION	MILD TO MODERATE DEHYDRATION	SEVERE DEHYDRATION
Mental status	Well, alert	Normal; fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty, eager to drink	Drinks poorly, unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skinfold	Instant recoil	Recoil in < 2 sec	Recoil > 2sec
Capillary refill	Normal	Prolonged	Prolonged, minimal
Extremities	Warm	Cool	Cold, mottled, cyanotic
Urine output	Normal to decreased	Decreased	Minimal

From Nelson’s Textbook of Pediatrics, Kliegman et al, Saunders, 18th edition¹

Figure 1: IMCI protocol for the recognition and management of diarrhoea

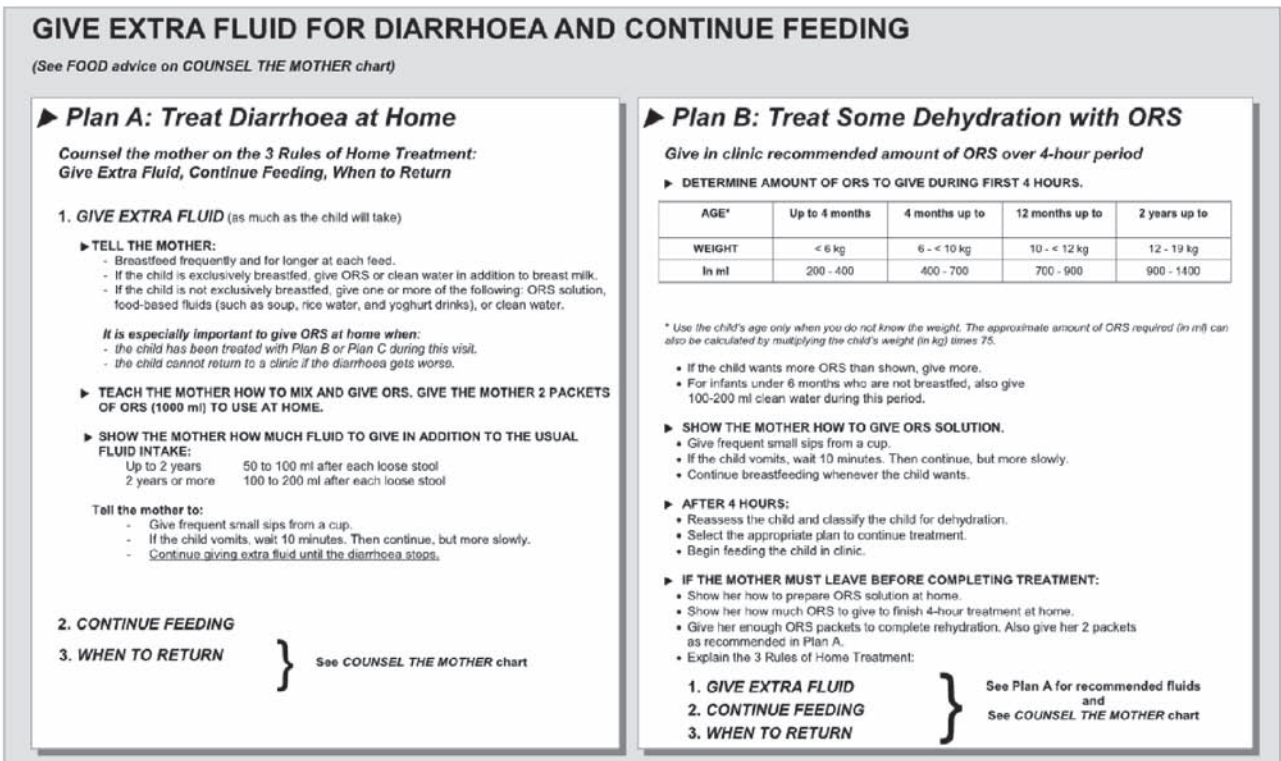


DANGER SIGNS, COUGH
DIARRHOEA

ASSESS AND CLASSIFY

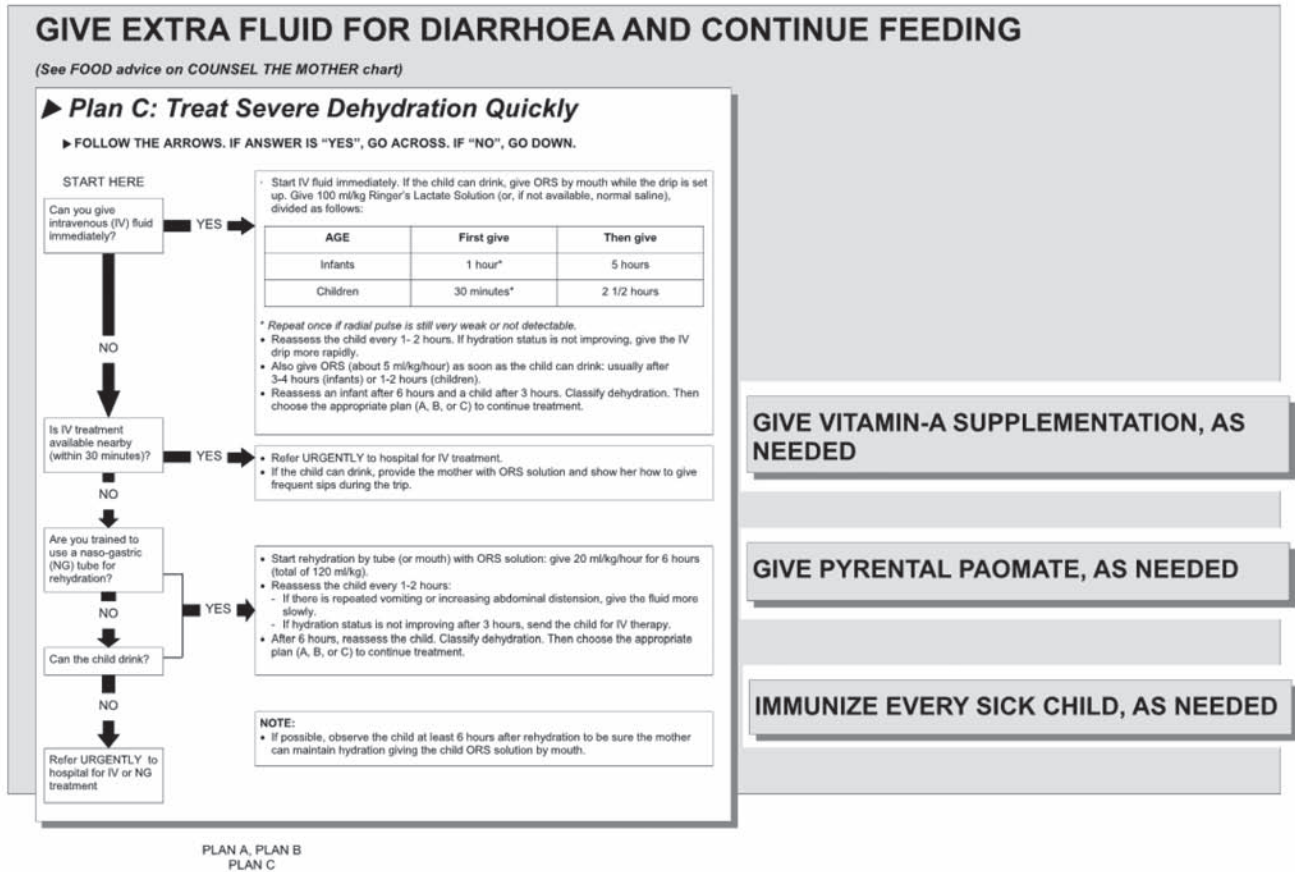
From IMCI Guidelines6

Figure 2: IMCI Treatment plans A and B for acute diarrhoea



From IMCI guidelines6

Figure 3: IMCI treatment plan C for acute diarrhoea



From IMCI guidelines⁶

Table III: Comparison of different ORS formula and ½ Darrow's Dextrose used for intravenous rehydration

	SAPA ORS	WHO-ORS Standard	WHO-ORS Reduced osmolarity	½ Darrow's Dextrose	Gastrolyte	Hydrol	Rehidrat
Sodium (mmol/l)	64	90	75	61	64	64	50
Potassium (mmol/l)	20	20	20	17	20	20	20
Chloride (mmol/l)	54	80	65	51	54	54	50
Base (mmol/l)	30	30	10	27	10	88	20
Glucose	2%	2%	1.35%	5%		20g/24.69g sachet	4.16g/14g sachet
Dextrose monohydrate					9.8g/13g sachet		
Sucrose							8.07g/14g sachet

SAPA South African Paediatric Association
 Lactate is being used in place of bicarbonate in half-strength Darrow's solution. Citrate is replacing bicarbonate in ORS powder mixtures as it increases the shelf-life and is equally effective as a base.

Adapted from Coovadia's Paediatrics and Childhealth, DF Wittenberg, Oxford University Press, 20092

2. Oral rehydration solutions (ORS)

The vast majority of infants and children can effectively be rehydrated with oral rehydration solutions. Caregivers are taught to start with 50–100 ml after each loose stool in children less than two years of age and 100–200 ml after each loose stool in children older than two years. Important in cases of vomiting, is to give small quantities of fluid at a time, to prevent immediate vomiting due to vagal nerve irritation. Table III compares commercially available rehydration solutions with that proposed by the WHO and South African Paediatric Association. The mother can also be taught to mix a home prepared solution with one litre of boiled and cooled down water, eight teaspoons of sugar and half a teaspoon salt. It is however imperative to give written instructions to the mother, because confusion between the quantities of salt and sugar to be added can lead to severe hyponatraemia with devastating neurological consequences. Children who vomit continuously or refuse ORS can be rehydrated via nasogastric tube. Cases of failed oral rehydration, shock, or contra-indications to oral rehydration such as paralytic ileus will need intravenous rehydration. Once children are rehydrated, continued ORS should be given to replace ongoing losses till the diarrhoea has stopped.

3. Feeding

As far as tolerated, normal feeds, especially breastfeeding, should be continued. Offering regular small feeds is often successful in achieving adequate intake. Formula should not be diluted. Food with complex carbohydrates (rice, wheat, potatoes, bread and cereals) are usually tolerated well. Fatty foods or food high in simple sugars (juices, carbonated sodas) should be avoided. In some cases of prolonged diarrhoea where the intestinal brush border surface and luminal enzymes are affected, secondary lactose intolerance can ensue. Using fermented milk products like yoghurt may overcome the problem, but in selected cases temporary change to a lactose free formula and sometimes semi-elemental feeds is necessary.

Zinc supplementation

Oral zinc supplementation (10mg/d < 6months, 20mg/d > 6months) for 10–14 days during the acute diarrhoea episode reduces the duration and severity of diarrhoea in developing countries and could prevent 300 000 deaths.¹ Previously it was thought that zinc supplementation stimulates the immune system and corrects zinc deficiency, but recent studies show that zinc is also beneficial in children that are not zinc deficient, acting in a drug-like manner, being pathogen and toxin specific. Research shows that zinc blocks the secretory effects of the cholera toxin or inhibits adhesion of pathogens in enteropathic *Escherichia Coli* infections.⁷

4. Additional therapies

Antimotility agents like loperamide are contraindicated in children. Similarly, due to the potentially serious side effects (lethargy, dystonia, malignant hyperpyrexia) of anti-emetics such as the phenothiazines, they are of little value, and careful oral rehydration is usually sufficient.¹ One of the newer anti-emetics,

ondansetron, is a selective serotonergic 5HT₃ receptor antagonist with no sedative effect or extrapyramidal reactions. This drug has been shown, in well designed studies, to be effective against placebo in relieving vomiting, reducing the need for intravenous fluids and decreasing hospitalisation.⁸

5. Antibiotic therapy

Timely antibiotic therapy in selected cases, such as dysentery where there is blood, mucus and leucocytes in the stool, may reduce the duration and severity of the diarrhoea. Ciprofloxacin 15 mg/kg bd for three days is currently the drug of choice.

6. Prevention

Promoting exclusive breastfeeding, improving complementary feeding practices and improving water and sanitation facilities as well as promotion of personal and domestic hygiene play a major role in the prevention of acute gastroenteritis. Rotavirus immunisation which is now included in the national immunisation programme will reduce the morbidity and mortality due to diarrhoea significantly. Prevention of malnutrition and vitamin A supplementation are further priorities. Improved management of diarrhoea through prompt identification and appropriate treatment significantly reduces the duration of diarrhoea, nutritional deterioration and mortality.

Conclusion

Acute gastroenteritis is a common problem in childhood that may be self-limiting and short lived, but may also have serious complications with a high morbidity and mortality. Through prompt identification and appropriate management as well as implementation of simple preventative measures the morbidity and mortality of acute diarrhoea can be reduced significantly.

Conflict of interest

The author has no conflict of interest to declare.

Acknowledgement

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