

Recent Advances in Management of Acute Diarrhoea in Children

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INTRODUCTION

Diarrhoea is most common health problem in children, especially those between 6 months and 2 years of age or under the age of 5 years. It is also common in babies under 6 months who are drinking cow's milk or infant feeding formulae. Frequent passing of normal stools is not diarrhoea. Babies who are breastfed often have stools that are soft; this is not diarrhoea. Diarrhoea is the number of stools normally passed in a day varies with the diet and the age of the child. In diarrhoea, stools contain more water than normal — they are often called loose or watery stools. They may also contain blood, in which case the diarrhoea is called dysentery. Diarrhoea remains the second leading cause of death among children under five globally. Nearly one in five child deaths — about 1.5 million each year is due to diarrhoea. It kills more young children than AIDS, malaria and measles combined¹.

Diarrhoea is more prevalent in the developing world due, in large part, to the lack of safe drinking water, sanitation and hygiene, as well as poorer overall health and nutritional status. According to the latest available figures, an estimated 2.5 billion people lack improved sanitation facilities, and nearly one billion people do not have access to safe drinking water. These unsanitary environments allow diarrhoea causing pathogens to spread more easily. Diarrhoea's status as the second leading killer of children under five is an alarming reminder of the exceptional vulnerability of children in developing countries. Saving the lives of millions of children at risk of death from diarrhoea is possible with a comprehensive strategy that ensures all children in need receive critical prevention and treatment measures².

In India the situation is going positively to achieve the child mortality related to MDG (millennium development goals). The data related to reducing under five mortality rate (U5MR) from 125 deaths per thousand live births in 1988-92 to 42 in

2015. The U5MR has decreased during the period 1998-2002 to 98 per thousand live births. The infant mortality rate (IMR) has also come down from 80 per thousand live births in 1990 to 60 per thousand in 2003 in contrast with Global data. There has been steady decline in the infant mortality rate from 92 per thousand live births in 1991 to 52 per thousand in 2003, under five child mortality rate has come down from 151 in 1990 to 78 per thousand in 2003.³ In 2006, for the first time, the number of children in the world dying before their fifth birthday fell below 10 million to 9.7 million⁴. More than 70 percent of almost 11 million child deaths every year are attributable to six causes: diarrhoea, malaria, neonatal infection, pneumonia, preterm delivery or lack of oxygen at birth. The major cause of death among children under five in developing countries in the year 2002 was diarrhoea accounting for 15% deaths.⁵

The latest UNICEF report says, 5,000 kids die daily under the age of five in India mainly due to preventable diseases. Diarrhoea is one of the main reasons which accounts for 10 to 20% of deaths in children of 0-5 years.

Diarrhoea:

Diagnosis is based on clinical symptoms, including the extent of dehydration, the type of diarrhoea exhibited, whether blood is visible in the stool, and the duration of the diarrhoea episode. Treatment regimens differ based on the outcomes of this clinical assessment. Microbiological culture and microscopy are not necessary to diagnose diarrhoea and initiate treatment, even in high-income countries, although these tools can help identify specific pathogens for outbreak investigations⁶. It is important that caregivers recognize the symptoms that require immediate attention from appropriate health personnel, including trained community health workers. These symptoms include dehydration, blood in the stool, profuse and persistent diarrhoea and repeated vomiting.

There are three main forms of acute childhood diarrhoea, all of which are potentially life-threatening and require different treatment courses:

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◆ **Acute watery diarrhoea:** This is associated with significant fluid loss and rapid dehydration in an infected individual. It usually lasts for several hours or days. The pathogens that generally cause acute watery diarrhoea include *V. cholerae* or *E. coli* bacteria, as well as rotavirus.

◆ **Bloody diarrhoea:** This is marked by visible blood in the stools. It is associated with intestinal damage and nutrient losses in an infected individual. The most common cause of bloody diarrhoea is *Shigella*. It is also known as dysentery.

◆ **Persistent diarrhoea:** This is an episode of diarrhoea, with or without blood that lasts at least 14 days. Undernourished children and those with other illnesses, such as AIDS, are more likely to develop persistent diarrhoea. Diarrhoea, in turn, tends to worsen their condition.

The children are more vulnerable to diarrhoea than adults. Children are also at greater risk than adults of life-threatening dehydration since water constitutes a greater proportion of children's body weight. Young children use more water over the course of a day given their higher metabolic rates, and their kidneys are less able to conserve water compared to older children and adults.⁷

TREATMENT:

The diarrhoea can be treated by replacing the loss of fluids by Oral Re-hydration Solution along with zinc sulphate tablets. The diarrhoea causes the dehydration, the dehydration usually occurs when the output of water and salts is greater

than the input. The more diarrhoea stools a child passes, the more water and salts he/she loses. Dehydration can also be caused by a lot of vomiting, which often accompanies diarrhoea. Dehydration occurs faster in infants and young children, in hot climates and when there is fever.

The treatment package focuses on two main elements, as outlined in a 2004 joint statement from UNICEF and WHO: 1) fluid replacement to prevent dehydration and 2) zinc treatment. Oral re-hydration therapy – which has been heralded as one of the most important medical advances of the 20th century is the cornerstone of fluid replacement. New aspects of this approach include low osmolarity oral re-hydration salts (ORS), which are more effective at replacing fluids than the original ORS formulation. The zinc treatment decreases diarrhoea severity and duration. Important additional components of the package are continued feeding, including breastfeeding, during diarrhoea episodes and the use of appropriate fluids available in the home if ORS are not available, along with increased fluids in general.⁸

Oral Re-hydration Solution is a mixture of clean water, salt and sugar, can be prepared and administered at home. It is estimated that this simple but effective solution has saved 40 million children's lives since it was first introduced in India in 1971.⁹

Zinc supplementation can reduce the duration of a diarrhoeal episode by 25 percent and is associated with a reduction in

Common ORS Available in Market			
Name	Weight	Price	Manufacturer
Walyte	21g/litre	Rs. 11.25	Wallace
Elect ORS	21g/litre	Rs. 13.50	Piramal HC
Electrokind	21.5g/litre	Rs. 12.00	FDC
Genlyte	21.5g/litre	Rs. 13.00	Cadila

Note: The ORS is also available in smaller packs to dissolve in 200ml of water. The WHO standard formula: 20.5g for 1000 ml. The commercial products have different weights because of use of other excipients.

Zinc Sulphate Available in Market		
Name	Price/No. Of Tablets	Manufacturer
Z & D DT 20	Rs. 22.00/ 7 Tablets	Dr. Reddy ' s

Note: Commercially Zinc tablets are not readily available

History:

The ancient Indian physician Sushruta date back over 2500 years used to treat acute diarrhoea with rice water, coconut juice, and carrot soup. However, this knowledge did not carry over to the Western world. The dehydration was found to be the major cause of death, secondary to the 1829 cholera pandemic in Russia and Western Europe. In 1831, William Brooke O'Shaughnessy noted the loss of water and salt in the stool of cholera patients and prescribed intravenous fluid therapy (IV) to compensate. The results were remarkable, as patients who were on the brink of death from dehydration recovered. The mortality rate of cholera dropped from 70% to 40% with the use of hypertonic IV solutions.¹¹ IV fluid replacement became entrenched as the standard of care for moderate /severe dehydration for over a hundred years. ORT replaced it with the support of several independent key advocates that ultimately convinced the medical community of the efficacy of ORT.¹²

In the late 1950s, ORT was prescribed by Dr. Hemendra Nath Chatterjee in India for cholera patients. Although his findings predate physiological studies, his results failed to gain credibility and recognition because they did not provide

scientific controls and detailed analysis.¹³ Credit for discovery that in the presence of glucose, sodium and chloride became absorbable during diarrhoea (in cholera patients) is typically ascribed to Dr. Robert A. Phillips. However, early attempts to translate this observation into an effective oral re-hydration solution failed, due to incorrect solution formula and inadequate methodology.¹²

In the early 1960s, biochemist Robert K. Crane discovered the sodium-glucose co-transport as the mechanism for intestinal glucose absorption¹⁴. Around the same time, others showed that the intestinal mucosa was not disrupted in cholera, as previously thought. These findings were confirmed in human experiments, where it was first shown that a glucose-saline oral therapy solution administered in quantities matching measured diarrhoea volumes was effective in significantly decreasing the necessity for IV fluids by 70-80%. These results helped establish the physiological basis for the use of ORT in clinical medicine¹¹.

Between 1980 and 2006, ORT decreased the number of worldwide deaths from 5 million a year to 3 million a year¹³. Death from diarrhoea was the leading cause of infant mortality in the developing world until ORT was introduced.¹⁹

Zinc Sulphate Available in Market			
Content		Concentration in mmol/l	
Sodium Chloride	2.6 g	Na ⁺	75
Potassium Chloride	1.5 g	K ⁺	20
Tri sodium Citrate	2.9 g	Cl ⁻	65
Glucose (anhydrous)	13.5 g	Glucose	75
		Citrate	10
Total Osmolarity = 245 mOsm/l			

A combined analysis of studies with low osmolarity ORS has revealed that stool volume is reduced by 20% and incidence of vomiting by 30%. The WHO/UNICEF have recommended replacement of standard (310 mOsm/l) ORS formula by the new mOsm/l.¹⁵ The development of this improved new formula for ORS with reduced levels of glucose and salt shortens the duration of diarrhoea and the need for unscheduled intravenous fluids.¹⁶

ORT is not designed to stop diarrhoea, but to restore and maintain hydration, electrolyte and pH balance until diarrhoea ceases, mostly spontaneously. It is the best and not

a second choice approach to intra venous hydration. Oral re-hydration salts (ORS) make a special drink that consists of a combination of dry salts. When properly mixed with safe water, the ORS drink can help re-hydrate the body when a lot of fluid has been lost due to diarrhoea. A child with diarrhoea should never be given any tablets, antibiotics or other medicines unless these have been prescribed by a medical professional or a trained health worker. The best treatment for diarrhoea is to drink lots of liquids and oral re-hydration salts (ORS) properly mixed with water.

Approximate Amount of ORS Required in the First 4 Hours ¹⁷						
Age	Less than 4 Months	4-11 Months	12-23 Months	2-4 years	5-14 years	15 years or older
Weight	Less than 5 kg	5-7.9 kg	8-10.9 kg	11-15.9 kg	16-29.9 kg	30 kg or more
ORS solution in ml	200-400	400-600	600-800	800-1200	1200-2200	2200-4000

The studies have shown that children receiving zinc experience a decrease in the severity of their diarrhoea episodes. A ten-day course has proven to provide a prophylactic protection against future bouts of diarrhoea for two to three months after the episode. The combined recommendation of zinc and ORS is a safe, effective and inexpensive diarrhoea treatment for children in the developing world. The only known side effect of zinc use is vomiting, which is rarely reported and is typically attributed to a metallic taste in the zinc. Use of high quality zinc products easily averts this side effect.

Based on WHO/UNICEF recommendation and realising the role of zinc in the management of diarrhoea, the Government of India has already issued new guidelines for the treatment of diarrhoea in children in 2007. The new recommendation includes Zinc in addition to ORS:¹⁸

- ◆ Use of 20 mg zinc sulphate dispersible tablets for use in childhood diarrhoea.
- ◆ Children aged 2 months to 6 months to be advised ½ tablets (10 mg) per day dissolved in breast milk. Those older than 6 months are advised to take 1 tablet a day dissolved in breast milk or water.
- ◆ The tablets are to be taken for 14 days beginning from the day the child sought care.’

Counselling to Mother: As the mother's role is very critical in the management of diarrhoea in children, it is essential that they should be properly counselled on the safe and effective use of ORS. It is necessary to ensure the mother that ORS does not reduce the diarrhoea but helps in treating diarrhoea and the diarrhoea will stop automatically.

1. Wash your hands thoroughly with soap and water.
2. Pour all ORS powder from a packet into a clean container.
3. Measure one litre of clean drinking water (freshly boiled and cooled drinking water) and pour into the container in which you poured ORS, if you have ORS packets for ½ litre of water then take ½ litre water.

4. Stir until all the powder in the container has been mixed with water and none remain at the bottom of the container.
5. Taste ORS solution before giving it to the child, it should taste like tears – neither too sweet nor too salty. If it tastes too sweet or too salty then throw away the solution and prepare ORS solution again.
6. Do not use ORS already prepared with water after one day (after 24 hours). Prepare a fresh solution.
7. Continue feeding including breast feeding the child. Starving a child who has diarrhoea can cause malnutrition or make it worse.

8. When to return to the clinic:

If a child passes many stools, is very thirsty, or has sunken eyes, the child probably is dehydrated. The child may need more treatment than the mother can give at home. The child should be taken to the doctor or hospital.

CONCLUSION:

Though India's progress towards child mortality related Millennium Development Goals is significant, still a lot to be done. Even now 5000 kids die every day due to preventable and treatable conditions. Diarrhoea continues to be a major contributing factor for childhood mortality.

The WHO/UNICEF and Government of India recommend the use of ORS and Zinc in the treatment of childhood diarrhoea. While ORS prevents dehydration and loss of electrolytes, the zinc sulphate tablets decrease the duration and severity of the diarrhoea. The ORS is readily available in the market but Zinc sulphate is not. Even the label of Zinc Sulphate tablet has a warning “WARNING – To be sold by retail on the prescription of a Registered Medical Practitioner only”. The Government of India has already made it clear that Zinc Sulphate does not fall under schedule H and is a OTC drug. This warning may discourage the people to use Zinc Sulphate. The Government of India must promote, through various means, the use of ORS together with Zinc for effective treatment of childhood diarrhoea, which would go in a long way reducing diarrhoea related deaths in children.

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