

ZODIAC of Diarrhea Management

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Diarrhea remains as one of the leading causes of under-five child mortality in India. 'ZODIAC' is an acronym that I have been using in my lectures to simplify learning the management of diarrhea. ZODIAC stands for:

- Z – Zinc (gives Z security to the gut)
- O – Oral Rehydration Solution (ORS)
- D – Diet (including continuation of breastfeeding)
- I – Immunization (Measles vaccine and Rotavirus vaccine)
- A – Antibiotics and Adjuncts (low down in the list; limited indications)
- C – Cleanliness (Personal and public) and Common sense

Let us see the rationale behind ZODIAC.

ZINC

Diarrhea leads to excessive loss of zinc – an essential nutrient that has a direct impact on the intestinal villus, brush border disaccharidase activity, and the intestinal transport of water and electrolytes in the body. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend zinc for the treatment of diarrhea [1]. Zinc supplementation given for 14 days during an episode of acute diarrhea not only reduces the duration and severity of the episode, but also reduces the likelihood of subsequent episodes in the following 2-3 months.

ORS

Dehydration is almost always the immediate cause of death in children with diarrhea. The prevention of dehydration should, therefore, be the first line of action in the treatment of diarrhea [2]. ORS is absorbed in the small intestine, replacing the water and electrolytes lost during diarrhea. In 1970s, owing to terrible suffering from acute dehydrating diarrhea and diarrhea-related diseases in the children from socioeconomically poor countries, the international health community joined in a global strategy to develop ORS. This development has saved thousands of infants and children from death [3]. The WHO and UNICEF currently recommends new reduced osmolarity ORS solution contains 75 mmol/L of sodium, 65 mmol/L of chloride, 75

mmol/L of glucose, 20 mmol/L of potassium and 110 mmol/L of citrate [4]. Low osmolarity **ORS** is the **Only Rehydrating Solution** for prevention of dehydration. Physicians treating diarrhea must give topmost priority to ORS in the prescription and must spend extra time or depute someone to explain the proper way of preparing ORS solution.

DIET

Everyone needs to remember and spread the message that the child should not be kept nil-by-mouth during diarrhea. All guidelines recommend that breastfeeding should be continued throughout the rehydration process. Infants over 6 months should be given cereals, vegetables and other foods. The food must be well cooked, and mashed or ground to enable easy digestion; fermented foods may be easier to digest. In addition, foods with higher potassium content, including bananas and green coconut water, are beneficial. During persistent diarrhea, animal milk is replaced with yoghurt (if available), as it contains less lactose and is better tolerated. If yoghurt is unavailable, animal milk is restricted to 50 mL/kg/day as greater amounts can exacerbate diarrhea. The milk must not be diluted. To break the vicious cycle of diarrhea and malnutrition, the WHO guidelines suggest continuing the nutrient-rich foods during and after diarrhea [4].

IMMUNIZATION

Vaccination is an effective strategy to prevent the occurrence or reduce the severity of diarrheal diseases, which in turn help in reducing the risk of malnutrition and developmental delay associated with severe and prolonged diarrhea in children. Rotavirus is the most common cause of severe dehydrating diarrhea in young children – globally accounting for an estimated 527 thousand deaths each year in children aged <2 years [5]. Measles is known to predispose to diarrheal disease secondary to measles-induced immune deficiency, and a high proportion of measles cases get complicated by diarrhea [6].

The decision to include a vaccine in the national immunization schedule depends on 'NESCAFE' – Need, Efficacy, Safety, Cost-effectiveness, Affordability,

Flexibility and Ethical issues. The decision to introduce the rotavirus vaccine into India's routine immunization schedule is a welcome move. In 2011, the Indian Academy of Paediatrics (IAP) included the rotavirus vaccine in its recommended immunization schedule, recognizing that the vaccine gives us a very real shot at reducing the morbidity and mortality of the disease. Every child is vulnerable to rotavirus diarrhea, regardless of where they live, and for those in places without accessible healthcare, it can be a death sentence. A single episode of moderate-to-severe diarrhea in young children disproportionately increases susceptibility to death by other causes. Being exposed to disease at an early age intensifies the risk of malnutrition, which, in turn, leads to poor physical, cognitive and emotional growth. A child protected by the rotavirus vaccine averts weakness and disease, and is better placed to perform.

ANTIBIOTICS

Viral pathogens, including rotavirus, account for most of the diarrheal episodes in under-five children. The WHO recommends the use of antibiotics only for cases with acute bloody diarrhea/dysentery. Overuse of antibiotics can lead to development of antimicrobial resistance (AMR), particularly in developing countries, where the incidence of infectious diseases is high. Rational usage of antimicrobials limits the development of AMR. Antibiotics are being misused in children with diarrhea and thus, caregivers need to be educated against this urgently [7,8].

CLEANLINESS

The primary sources of exposure to a diarrheogenic microbe are contaminated water, poor sanitation, and unhygienic conditions. Practicing open defecation or sharing sanitation facilities increases the burden of diarrheal disease, malnutrition, and diarrhea-related mortality. Currently, only 68% of the world's population and 38% of those living in the least developed countries meet the criteria for access to an improved sanitation facility [9]. Interventions supporting increased access to clean water and private household sanitation facilities may reduce exposure to enteric pathogens and thereby reduce the incidence of diarrhea among young children [9]. Washing hands with soap and clean water, using clean and safe methods of preparing and storing food, washing fruits and vegetables or cooking them well before eating, using a toilet for defecation, and covering food are important cleanliness practices to prevent diarrhea.

EPILOGUE

Diarrhea in children continues to pose a major public health

challenge despite significant advances in interventions. Reducing mortality rates largely depends on life-saving treatment with ORS and zinc to all the children suffering with diarrhea, whereas main tools of prevention are cleanliness and vaccination. As pediatricians, we endorse the move to introduce the rotavirus vaccine into the national immunization schedule of India. The vaccine is a cost-effective intervention poised to make a much needed positive impact on public health in India. It will go a long way to ensure that Indian infants and children are protected against diarrhea, the second largest killer of Indian children.

I hope that the prescription rates of ORS and zinc improve, children continue to get breastfeeding and usual diet during diarrhea, children are routinely administered the measles and rotavirus vaccines, antibiotic abuse is avoided, and parents observe cleanliness and apply common sense while bringing up children.

REFERENCES

1. UNICEF. Clinical Management of Acute Diarrhea. WHO/ UNICEF Joint Statement 2004. Available from: http://www.unicef.org/publications/files/ENAcute_Diarrhea_reprint.pdf. Accessed May 04, 2016.
2. Munos, MK, Walker CL, Black RE. The effect of oral rehydration solution and recommended home fluids on diarrhea mortality. *Int J Epidemiol.* 2010; 39(Suppl 1):i75-87.
3. Oral Rehydration Therapy: A Revolution in Child Survival. Available from: http://pdf.usaid.gov/pdf_docs/PNAAZ606.pdf. Accessed April 29, 2016.
4. WHO. The Treatment of Diarrhea: A Manual for Physicians and Other Senior Health Workers. 2005. Available from: <http://apps.who.int/iris/bitstream/10665/43209/1/9241593180.pdf>. Accessed May 04, 2016.
5. Das JK, Tripathi A, Ali A, Hassan A, Dojosoendy C, Bhutta ZA. Vaccines for the prevention of diarrhea due to cholera, shigella, ETEC and rotavirus. *BMC Public Health.* 2013;13(Suppl 3):S11.
6. Perry RT, Halsey NA. The clinical significance of measles: A review. *J Infect Dis.* 2004;189(Suppl 1):S4-16.
7. Kotwani A, Chaudhury RR, Holloway K. Antibiotic-prescribing practices of primary care prescribers for acute diarrhea in New Delhi, India. *Value Health.* 2012;15(Suppl 1):S116-9.
8. Ekwochi U, Chinawa JM, Obi I, Obu HA, Agwu S. Use and/or misuse of antibiotics in management of diarrhea among children in Enugu, Southeast Nigeria. *J Trop Pediatr.* 2013;59:314-6.
9. Baker KK, O'Reilly CE, Levine MM, Kotloff KL, Nataro JP, Ayers TL, *et al.* Sanitation and hygiene-specific risk factors for moderate-to-severe diarrhea in young children in the Global Enteric Multicenter Study, 2007-2011: Case-control study. *PLoS Med.* 2016;13:e1002010.