**الجامعة المستنصرية -كلية الطب**

**المرحلة الرابعة**

**Gastroenteritis 1&2**

**Definition**

It is the process of malabsorption or increase secretion of fluid & electrolytes that led to an increased frequency, volume & fluidity of the stool apart from normal.

Excessive loss of fluid and electrolytes in the stool.

**acute diarrhea** is defined as the sudden onset of the excessive loose stool of more than 10 g/kg/day in infants or more than 200 g/24 hr. in older children.

In clinical practice, and in accordance with World Health Organization (WHO), it is acceptable to define diarrhea as

“the passage of 3 or more loose or liquid stools per day, or more frequently

than is normal for the individual.”

**persistent diarrhea:** is defined as an episode that begins acutely but last for 14 or more days, it has a case fatality rate of 60%

**Prolonged (lasting 7-13 days)**

**Chronic diarrhea** is defined as stool volume of more than 10 g/kg/day in

toddlers/infants and greater than 200 g/day in older children that lasts for 4 wk or

more.

**Dysentery**

refers to a syndrome characterized by frequent small stools containing visible blood, often accompanied by fever, tenesmus, and abdominal pain. This should be distinguished from bloody diarrhea (larger volume bloody stools with less systemic illness) because the etiologies may differ.

Diarrhea is the leading cause of morbidity and the second most common disease in children in the developing world; it is a major cause of childhood mortality.

**CAUSES:**

**Viruses:** Responsible for more than 50% of all cases of GE in summer & 80% in Winter. (Rotavirus/Adenovirus/Astrovirus/Calicivirus)

**Bacteria:**(Escherichia Coli / Campylobacter Jejune /Shigella/Yersinia Enterocolitica / Vibrio cholerae/ Salmonella/Clostridium Difficile)

**Parasite:** (Entamoeba histolytica/Giardia lamblia/Cryptosporidium parvum)

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**MECHANISMS OF DIARRHEA**

Secretory diarrhea occurs when the intestinal mucosa directly secretes fluid and electrolytes into the stool. Pathogens primarily manifesting as secretory diarrhea attach to the surface of

the epithelium and stimulate secretion of water and electrolytes by activating

adenylate cyclase and raising intracellular cAMP (*V. cholerae* and heat- Labile

producing ETEC) and/or cGMP (ETEC producing heat-Stable)

The diarrheagenic phenotype of *C. difficile* is attributed to production of toxins A (an enterotoxin) and B (an enterotoxin and cytotoxin).

Osmotic diarrhea occurs after the malabsorption of ingested substances, which pull water into the bowel lumen. A classic example is **lactose intolerance**. Certain non-absorbable **laxatives**, such as polyethylene glycol and magnesium hydroxide (milk of magnesia) also cause osmotic diarrhea.

|  |  |  |
| --- | --- | --- |
| **Stool** | **Osmotic diarrhea** | **Secretory diarrhea** |
| Electrolytes | Na <70mEq/l | Na >70mEq/l |
| osmolality | >(Na +K) \*2 | =(Na +K) \*2 |
| PH | <5 | >5 |
| Reducing substances | POSITIVE | NEGATIVE |
| volume | <200ml/day | >200ml/day |

Another way to differentiate between osmotic and secretory diarrhea is to stop all feedings and observe. This observation must be done only in a hospitalized patient receiving IV fluids to prevent dehydration. If diarrhea stops completely while the patient is receiving nothing by mouth (NPO), the patient has osmotic diarrhea.

Neither of these methods for classifying diarrhea works perfectly because most diarrheal illnesses are a mixture of secretory and osmotic components.

*Shigella* , nontyphoidal salmon., *Campylobacter* , and *Yersinia* all possess an invasive

phenotype and elicit diarrhea by a variety of mechanisms that generally involves

elicitation of inflammatory cytokines with or without associated toxin

production.

**Clinical Manifestation**

Gastroenteritis may be accompanied by **systemic findings**, such as fever, lethargy, and abdominal pain.

1. **VIRAL DIARRHEA**

Is characterized by watery stools, with no blood or mucus. Vomiting may be present, and dehydration may be prominent. Fever, when present, is low grade.

**2. DYSENTERY**

Is diarrhea involving the colon and rectum, with blood and mucus, possibly foul smelling, and fever.

* 1. (Shigella/EIEC, EHEC, /E. Histolytica (**amebic dysentery**), C.Jejuni,Y. Enterocolitica, nontyphoidal salmonella). Gastrointestinal bleeding and blood loss may be significant.

**3. ENTEROTOXIGENIC DISEASE:** is caused by agents that produce enterotoxins, such as v. cholerae and ETEC( this organism is associated with 40% to 60% of cases of traveler's diarrhea). In this diarrhea fever is absent or only low grade.

Diarrhea usually involves the ileum with watery stools without blood or mucus and usually lasts 3 to 4 days with four to five loose stools per day.

**4. GIARDIASIS.** Insidious onset of progressive anorexia, nausea, gaseousness, abdominal distention, watery diarrhea, secondary lactose intolerance, and weight loss is characteristic of giardiasis.

**Differential diagnosis of gastroenteritis**

**Systemic infection:** septicemia, meningitis

**Local infections:** Respiratory tract infection, otitis media, hepatitis A, urinary tract infection

**Surgical disorders:** Pyloric stenosis, intussusception, acute appendicitis, necrotizing enterocolitis, Hirschsprung disease

**Metabolic disorder:** Diabetic ketoacidosis

**Renal disorder**: Haemolytic uraemic syndrome

**Other:** Coeliac disease, cow’s milk protein intolerance, adrenal insufficiency

**Dehydration**

A chief consideration in the management of a child with diarrhea is to assess the degree of dehydration. The degree of dehydration dictates the urgency of the situation and the volume of fluid needed for rehydration. The World Health Organization defines some dehydration as the presence of two or more of the following signs: restlessness/irritability, sunken eyes, drinks eagerly, thirsty,and skin pinch goes back slowly. Severe dehydration is defined as two or more of the following signs: lethargy/unconsciousness, sunken eyes, unable to drink/drinks poorly, and skin pinch goes

back very slowly (>2 sec).

**Assessment of degree of dehydration (new method)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **NO** | **SOME** | **SEVERE** |
| **Condition** | Well, alert | Restless, irritable | Lethargic, unconscious |
| **Eyes** | Normal | Sunken | Very sunken |
| **Tears** | present | Absent | Absent |
| **Mouth&tongue** | Moist | Dry | Very dry |
| **Thirst** | Drinks normally | Thirsty or drinks eagerly | Unable to drink |
| **Skin turgor** | Go back quickly | Goes back slowly | Goes back very slowly |

**Assessment of Degree of Dehydration**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Mild** | **Moderate** | **Severe** |
| **Infant** | 5% | 10% | 15% |
| **Adolescent** | 3% | 6% | 9% |
| **Infants and young children** | Thirsty; alert; restless | Thirsty; restless or lethargic but irritable or drowsy | Drowsy; limp, cold, sweaty, cyanotic extremities; may be comatose |
| **Older children** | Thirsty; alert; restless | Thirsty; alert(usually) | Usually conscious (but at a reduced level) apprehensive; cold, sweaty, cyanotic extremities; wrinkled skin on fingers and toes; muscle cramps |
| **Signs and Symptoms** | | | |
| **Tachycardia** | Absent | Present | Present |
| **Palpable pulses** | Present | Present (weak) | Decreased |
| **Blood pressure** | Normal | Orthostatic hypotension | Hypotension |
| **Cutaneous perfusion** | Normal | Normal | Reduced and mottled |
| **Skin turgor** | Normal | Slight reduction | Reduced |
| **Fontanel** | Normal | Slightly depressed | Sunken |
| **Mucous membrane** | Moist | Dry | Very dry |
| **Tears** | Present | Present or absent | Absent |
| **Respirations** | Normal | Deep, may be rapid | Deep and rapid |
| **Urine output** | Normal | Oliguria | Anuria and severe oliguria |

**Types of dehydration**

**1. Isotonic dehydration:** It is the most common type 70%, it occurs when the net loss of water &Na is in the same proportion as that found in the normal ECF.

**2. Hypernatremic (hypertonic) dehydration**: It is less frequent15%-20, but the most dangerous type,as it is associated with serious neurological damage (CNS hemorrhage or thrombosis)these complications occur secondary to movement of water from the brain cells into the hypertonic ECF, causing brain cell shrinkage & tearing of blood vessels within the brain.

occur when Na loss >water loss (i.e. s. Na>150meq/L& s. osmol.>295 mosm ,it may occur during the course of diarrhea when oral homemade electrolyte solutions with high concentrations of salt are administered **.**increases with increased evaporative water loss as a result of fever, high environmental temperatures, and hyperventilation, and with decreased availability of free water

**3. Hyponatremic dehydration:**  is seen in approximately 10–15% of all patients with diarrhea. It occurs when large amounts of electrolytes, especially sodium, are lost in the stool out of proportion to fluid losses. It occurs more frequently with bacillary dysentery or cholera. Hyponatremia may develop or worsen if there is a considerable oral intake of low-electrolyte or electrolyte-free fluids during diarrhea

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Isotonic dehydration** | **Hypertonic** | **Hypotonic** |
| Water &Na loss | Balanced deficit of water &Na | Deficit of water >Na | Water loss<Na |
| S.Na(mmol/L)  S.osmolarity(mOsmol/L) | Normal(130-150)  Normal (275-295) | Elevated>150  Elevated >295 | Decrease<130  Decrease<275 |
| Clinical manifestation | The usual signs of dehydration as mentioned in the table | Thirst is severe & out of proportion to the apparent degree of dehydration.  Irritability, hypertonia hyperreflexia, Convulsions esp>s.Na>165mmol/L  Normal or full fontanel  Normal eyes/U.O.P preserved longer than other type/Brought to medical attention with profound  dehydration/Doughy abd.  Woody tongue | Lethargy  Infreq. convulsion |

Clinical assessment of dehydration is only an estimate; the patient must be continually reevaluated during therapy.

The degree of dehydration is underestimated in hypernatremic dehydration because the osmotically driven shift of water from the intracellular space to the extracellular space helps to preserve the intravascular volume. The opposite occurs with hyponatremic dehydration.

**Complications**

1. Dehydration, metabolic acidosis, shock, and acute renal shutdown.

2. Electrolyte disturbance; hypokalemia (abdominal distention), hypernatremia & hyponatremia.

3. Convulsion; might be due to:

A. Hyper or hyponatremia.

B. Fever either because of the primary infection or dehydration fever.

C. Hypoglycemia (due to fasting & glycogen mass is small in children).

D. Hypocalcemia is usually associated with hypernatremia.

E. Toxic convulsion (e.g., Toxin secreted by shigella).

F. GE may present as a prodromal period of CNS infection like meningitis.

4. EHEC, especially the E. Coli O157:H7 strain, produces a Shiga-like toxin that is responsible for hemorrhagic colitis and most cases of a hemolytic uremic syndrome (HUS), which is a syndrome of microangiopathic hemolytic anemia, thrombocytopenia, and renal failure.

5. Post-AGE syndrome (persistent diarrhea):

A. Secondary (transient) lactose deficiency. Can be diagnosed by finding low PH & a positive reducing substance in stool, hydrogen breath test, or by measurement of mucosal lactase concentration with a small bowel biopsy. Diagnostic testing is not mandatory & often simple dietary changes (reduce or eliminate lactose from the diet) result in symptom relief.

B. Cow s milk/ soy protein intolerance.

C. Persistent infection. E.G. Giardia.

**LABORATORY EVALUATION**

**1. Stool** specimens should be examined

* macroscopically for mucus, and blood, and
* microscopically for RBC & leukocytes, which indicate colitis.
  1. Fecal leukocytes are present in response to bacteria that diffusely invade the colonic mucosa. Such as shigella, salmonella, C. Jejuni, and invasive E. Coli.

Also, look for trophozoites and/or cysts of E. histolytica or giardia.

If the stool test result is negative for blood and WBCs, and there is no history to suggest contaminated food ingestion, a viral etiology is most likely.

A rapid diagnostic test for rotavirus in stool should be performed, especially during the winter. Enzyme-linked immunosorbent assays, which offer >90% specificity and sensitivity, are available for detection of group A rotavirus. Latex agglutination assays are also available for group A rotavirus and are less sensitive

**Stool cultures** are recommended for patients with fever, profuse diarrhea, and dehydration, bloody diarrhea and in cases when you suspect organisms that need antibiotic therapy or if HUS is suspected.

**2 Electrolytes, BUN, creatinine, a complete blood count,** Hemoconcentration from dehydration causes an increase in the hematocrit and hemoglobin.

**3. Urinalysis** for specific gravity as an indicator of hydration. The urine specific gravity is usually elevated (≥1.025). Urinalysis may show hyaline and granular casts, a few WBC and RBC, and 30 to 100 mg/dl of proteinuria. If UTI is suspected, urine should be sent for C&S test.

**4.** Positive **blood cultures** are uncommon with bacterial enteritis except for *S. typhi* (typhoid fever) and for nontyphoidal *Salmonella* and *E. coli* enteritis in very young infants.

**Treatment of gastroenteritis**

* Most infectious causes of diarrhea in children are self-limited.
* Management of viral and most bacterial causes of diarrhea is **primarily supportive** and consists of correcting dehydration and ongoing fluid and electrolyte deficits and managing secondary complications resulting from mucosal injury. Antibiotic is not indicated for routine use.

Indications of using Antibiotics in gastroenteritis

* Antimicrobials are reliably helpful only for children with:

1. bloody diarrhea (most likely shigellosis),
2. suspected cholera with severe dehydration,
3. serious nonintestinal infections (e.g., pneumonia).
4. Antiprotozoal drugs can be very effective for diarrhea in children, especially for Giardia, Entamoeba histolytica, and now Cryptosporidium, with nitazoxanide.
5. All severely malnourished children should receive broad-spectrum antibiotics for infections.
6. Toxic febrile child, age< 3 months.

Indications for hospital admission



**Treatment of viral AGE consists mainly of**

Fluid (ORS or intravenous fluid)

Feeding

Zinc

**ORS**

As a guideline for ORS, it is advisable to give it in case of GE with **no signs of dehydration** to prevent dehydration. The **deficit** in case of **mild dehydration** gives 50 ml/kg and 100 ml/kg for **moderate dehydration** to be given within 4 hours.

Supplementary ORS is given to replace ongoing losses from diarrhea or emesis.

An additional 10 ml/kg of ORS is given for each stool.

**Losses(10ml/kg/bowel motion//// 2ml/kg for each vomitus)**

Fluid intake should be decreased if the patient appears fully hydrated earlier than expected or develops periorbital edema.

**Composition of ORS,**

* Nacl……... 2.6g/l.
* Kcl ……… 1.5g/l.
* Na citrate… 2.9g/l.
* Glucose…. 13.5g/l.

**Concentration of ors,**

* Na→ 75 mmol/l.
* Cl → 65 mmol/l
* K → 20 mmol/l.
* Na citrate →10 mmol/l.
* Glucose → 75 mmol/l.

Osmolality-----245

**Steps for treatment of AGE:**

**1. Correction of dehydration:**

* The first step in caring for a child with dehydration is to assess the degree of dehydration.

The degree of dehydration dictates the urgency of the situation and the volume of fluid needed for rehydration. Correction of dehydration require first assessing the degree of dehydration &accordingly choosing the appropriate plan

|  |  |  |  |
| --- | --- | --- | --- |
| **Assess for dehydration** | | | |
| **Look**  consciousness  Eye  Tears  Mouth, tongue  Thirst | Well, alert  Normal  Present  Moist  Not thirsty | Restless, irritable  Sunken  Absent  Dry  Thirsty, drink eagerly | Lethargic, unconscious  Very sunken  Absent  Very dry  Not able to drink |
| **Feel** skin turgor | Goes back quickly | Goes back slowly | Goes back very slowly |
| **Decide** | No dehydration | Some dehydration | Severe dehydration |
| **Treat** | Plan A | Plan B | Plan C |

**PLAN -A-**

**Fluid:**  Treatment here is directed towards preventing dehydration by giving extra fluid & salt to replace diarrheal loss. The mother is instructed to give extra amount of suitable fluids

* Fluids should be given as much as the child wants till diarrhea stops.
* as a role the child should receive ORS at least AFTER EACH BOWEL MOTION:
* 1/4-1/2 large cup (50-100ml) fluids (for children <2y)

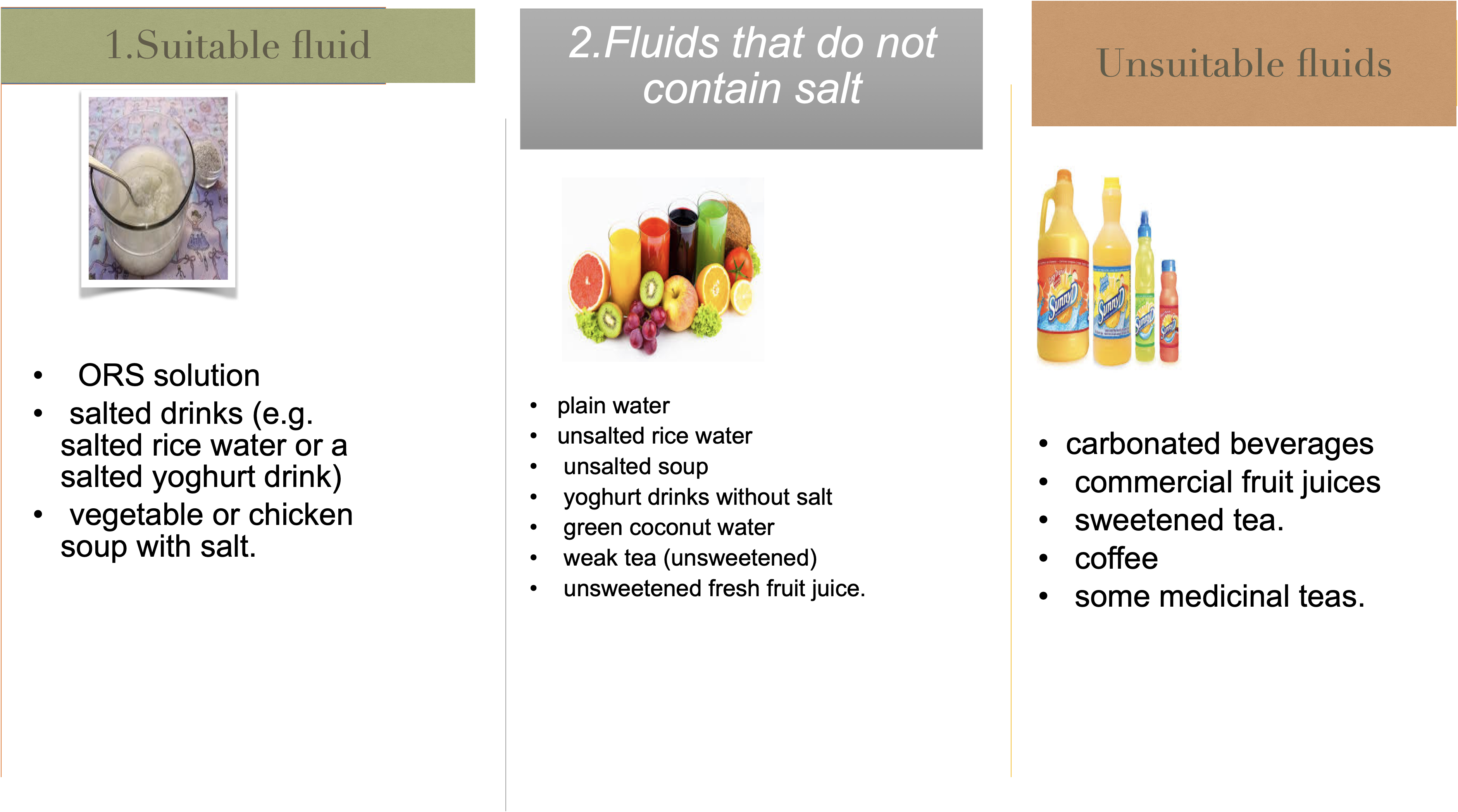
1/2-1large cup (100-200ml) fluids (for children 2-10y)

**FEEDING**

part of the treatment is to **continue feeding** to prevent malnutrition.

* 1. Most children with watery diarrhea regain appetite when dehydration is corrected while those with dysentery remain anorexic till the disease resolves.
  2. Continuing feeding during diarrhea also speeds up the recovery of normal intestinal mucosa function.

Breastfeeding should be continued &artificial feeds if used should be given with very careful attention to sterilization.DO NOT DILUTE THE MILK



**Zinc supplementation**

* Zinc decreases the length and severity of diarrhea.
* Zinc is important for the child’s immune system and will help the child fight off new episodes of diarrhea in the 2-3 months following treatment.
* Zinc improves appetite and growth.

Children less than 6 months of age should receive (10mg) once a day for 10-14 days. Children 6 months and older receive 20 mg per day for 10-14 days.

Lastly, the mother should be **instructed to take the child to the hospital** if he starts to develop one or more of the following:

Passing much watery stool

Repeated vomiting.

Severe thirst.

Poor eating or drinking.

Fever.

Blood in stool.

No improvement after 3 days.

**PLANE –B-**

If there is some dehydration PLANE –B-

A child with some signs of dehydration needs extra fluids and food.

**Fluid** Treat the child with ORS first in the health facility and then, when all signs of dehydration have disappeared, the child should be sent home for continued treatment.

Give ORS in the clinic until the skin pinch is normal, the thirst is over, the child is calm. Four hours of rehydration are usually necessary for this.

**Feeding**

* 1. In addition to fluid, the child with SOME DEHYDRATION needs food.

Breastfed children should continue breastfeeding. Other children should receive their usual milk or some nutritious food after 4 hours of treatment with ORS.

Give the first zinc supplement in the clinic. Instruct the mother that zinc should be continued for 10/14 days with the recommended dose depends on the child’s age.

**Zinc**: should be given as soon as the child can eat and has successfully completed 4 hours of rehydration.

**ORS**

Oral rehydration salt (ORS)solution is the fluid specifically developed for ORT.Oral rehydration therapy (ORT) is the administration of fluid by mouth to prevent or correct dehydration that is a consequence of diarrhea.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SOLUTION** | CARBOHYDRATE (g/L) | SODIUM (mmol/L) | POTASSIUM (mmol/L) | CHLORIDE (mmol/L) | BASE\* (mmol/L) | OSMOLARITY (mOsm/L) |
| ORS |
| **Low osmolality ORS** | 13.5 | 75 | 20 | 65 | 10 | 245 |
| **WHO (2005)** |  |  |  |  |  |  |
| **WHO (2002)** | 13.5 | 75 | 20 | 65 | 30 | 245 |
| **WHO (1975)** | 20 | 90 | 20 | 80 | 10 | 311 |

The principle of the ORT: is based on that intestinal absorption of Na, other electrolytes &water is enhanced by active absorption of certain food molecules such as glucose &L-amino acids

The process of active absorption continues to function normally during secretory diarrhea when other pathways are impaired .so if the patient with secretory diarrhea drinks an isotonic salt solution that does not contain a source of glucose or amino acids. Na is not absorbed &the fluid remains in the gut which will be added to the volume of the stool.

A more effective, lower-osmolarity ORS with reduced concentrations of sodium and glucose associated with less vomiting, less stool output, and a reduced need for intravenous infusions in comparison with standard ORS has been developed for global use.

**Advantage of ORS over IV therapy,**

**1.** Less expensive, available & easily prepared.

**2.** Given by normal oral root.

**3.** Shorter time for correction of dehydration (4hr) instead of (24hr) in IV therapy

**4.** No complication that occur with IV therapy like pain, phlebitis, thromboembolic phenomena, over hydration……

**5.** Successful in more than 95% of all cases of AGE, and has lessened diarrhea-associated malnutrition.

* When rehydration is complete, **maintenance therapy** should be started, using 100 ml of ORS/kg/24 hr until the diarrhea stops.
* Breastfeeding or formula-feeding should be maintained and not delayed for more than 24 hours. Also to continue on soft easily digestible diet in small &frequent period.
* Patients with more severe diarrhea require continued supervision. The volume of ORS ingested should equal the volume of stool losses. If stool volume cannot be measured, an intake of 10 to 15 ml of ORS/kg/hr is appropriate.
* Low-osmolarity ORS can be given to all age groups, with any cause of diarrhea. It is safe in the presence of hypernatremia, as well as hyponatremia (except when edema is present). Some commercially available formulations that can be used as ORS include Pedialyte Liters (Abbott Nutrition), CeraLyte (Cero Products), and Enfalac Lytren (Mead Johnson). Popular beverages that should not be used for rehydration include apple juice, Gatorade, and commercial soft drinks.

**How to prepare & to give ORS**

ORS should be dissolved with appropriate amount of sterile water according to the instruction in the container, and should be given by spoon or syringe (but not by feeding bottles), in sips every few minutes according to the severity of vomiting.

ORS should not be used 24hr after preparation. Also, should be kept in the fridge.

**Contraindication for ORS**

**1**.Severe & persistent vomiting.

**2.** Severe dehydration approaching to shock.

**3.** Severe diarrhea (more than 10ml/kg/bowel motion.

**4.** Inability to have oral fluid as in case of change in level of consciousness (stupor, coma…) because of risk of aspiration.

**5.** If you need IV line for other purposes (sepsis, other medication….).

**Example; a** 9 mo old infant presented with history of acute gastroenteritis**, mild dehydration** & his body weight is 8 kg. Calculate the total amount of ORS for this infant & how are you going to give it in the next 24hr.

**1.** Calculate the deficit: 50 ml / kg  50ml × 8 = 400 ml

**2.** to be given in 4 hr. by spoon or syringe (but not by feeding bottles), in sips every

few minutes.

**3.** Maintenance: 100 ml / kg /24 hr. until the diarrhea will stop.

**4.** Supplementary ORS is given to replace ongoing losses from diarrhea or emesis.

**5.** An additional 10 ml/kg of ORS is given for each stool.

**Example;**   A 5-mo old infant presented with history of acute gastroenteritis; **moderate dehydration** & his body weight is 6 kg. Calculate the total amount of ORS for this infant & how are you going to give it in the next 24hr.

**1.** Calculate the deficit: 100 ml / kg  ///100ml × 6 = 600 ml  **2.** to be given in 4 hr. by spoon or syringe (but not by feeding bottles), in sips every few minutes.  **3.** Maintenance: 100 ml / kg /kg/24 hr. until the diarrhea will stop. **4.** Supplementary ORS is given to replace ongoing losses from diarrhea or emesis. **5.** An additional 10 ml/kg of ORS is given for each stool.

**Plan C**

**IV fluid management of dehydration.**

General fluid management (for hyponatremic & isonatremic dehydration).

1. Restore intravascular volume (**fluid bolus**). {NOTE; A child with mild dehydration does not usually require a fluid bolus. In contrast, a child with severe dehydration may require multiple fluid boluses and may need to receive fluid at a faster rate}. **Normal saline: 20 ml/kg over 20 min (repeat as needed).**

2. Calculate 24-hr fluid needs: **maintenance + deficit volume.**

(Subtract fluid administered from 24hr fluid needs.) (Select an appropriate fluid based on total water and electrolyte needs), usually 1/3th to 1/5th GS.

**Calculate the deficit**

|  |  |
| --- | --- |
| **Degree of dehydration** | **deficit (cc/kg)** |
| Mild dehydration | 50 |
| Moderate dehydration | 100 |
| Severe dehydration | 100-150 (in practice we use 100) |

**Calculate the maintenance**

|  |  |
| --- | --- |
| **Body wt** | **Maintenance (cc/kg/day)** |
| 1st 10 kg | 100 |
| 2nd 10 kg | 50 |
| Each additional kg | 20 |

**3.**Administer half the calculated fluid during the first 8 hr, (first subtracting any boluses from this amount). **4.**Administer the remainder over the next 16 hr. **5.** Replace ongoing losses as they occur.

**Example;**   A 11mo old infant presented with history of acute gastroenteritis, he had persistent vomiting and cannot tolerate ORS, on examination had mild dehydration & his body weight is 10kg. Calculate the total amount of fluid for this infant & how are you going to give it in the next 24 hr?.

1. Calculate 24-hr fluid needs (maintenance) + deficit volume.  Maintenance: 1st 10 kg = 100 ml × kg so: 100 ml × 10 = 1000 ml  Deficit: mild 50 ml / kg  50 ml × 10 kg = 500ml  2. Total amount of fluid required in the next 24hr is 1500 ml.  3. Half to be given in the 1st 8hr = 750 ml.  4. Second half (750 ml) in the next 16hr.  5. Add 20 meq/L potassium chloride unless contraindicated (no urine output).

**Example;** an 8-mo old infant presented with history of acute gastroenteritis; severe dehydration & his body weight is 8 kg. Calculate the total amount of fluid for this infant & how are you going to give it in the next 24hr.

1. Calculate 24-hr fluid needs (maintenance) + deficit volume.  Maintenance: 1st 10 kg = 100 ml × kg  so: 100 ml × 8 = 800 ml  deficit: severe 10 ml / kg 100 ml × 8 kg = 1000 ml  2. Total amount of fluid required in the next 24hr is 1800 ml.  3. Give bolus shoot 20 ml / kg  20 ml × 8 = 160 ml to be given in 20 min  the remaining fluid is 1640 ml  4. Half to be given in the 1st 7hr = 820ml.

5. Second half (820 ml) in the next 16hr.  6. Add 20 meq/L potassium chloride unless contraindicated (no urine output).

NOTE: This patient my need up to 3 boluses according to response so any amount of bolus used should be subtracted from the maintenance

**Note:** In Hyponatremic dehydration; (serum Na < 130meq/l).Occurs in children who have diarrhea & consume a hypotonic fluid (water or diluted formula). rapid correction of hyponatremia (>12meq/l/24hr.) Should be avoided because of the risk of (central pontine myelinolysis).

**Additional therapies**

**Probiotic:** A varieties of organisms has a good safety record *(lactobacillus, Bifidobacterium*)

* The use of probiotic non pathogenic bacteria for prevention and therapy of diarrhea has been successful in some settings
* Restoring beneficial intestinal flora
* Enhance host protective immunity
* *Saccharomyces boulardii* is effective in antibiotic-associated and in *C. difficile*

Diarrhea.

**Anti-motility agents: loperamide** are contraindicated in children with dysentary and probably have no role in the management of acute watery diarrhea in otherwise healthy children

**Antiemetic:** antiemetic as phenothiazines are of little value and associated with potentially serious side effects (lethargy ,dystonia,malignant hyperpyrexia) .

nonetheless ondansetron is an effective and less toxic anti emetic agent its useful adjust to the treatment of vomiting in ambulatory setting with reduced risk of intravenous fluids requirement and hospitalization.however, most children do not require specific antiemetic therapy, careful ORT is usually sufficient

**Racecadotril :**An enkephalins inhibitor it has inconsistently shown to reduce stool output in patient with diarrhea, experience with it is limited For the average child it may be unnecessary.

**Prevention of gastroenteritis**

It can be accomplished by;

1-Improving case Rx & tracing the source .

2-Promotion of exclusive breast-feeding in the first 4-6 mo of age, Breastfeeding should continue for up to 2 yr .

3- Improved complementary feeding practices.

4-Improved water and sanitary facilities .

5- Promotion of personal and domestic hygiene.

6- Rotavirus immunization.

7-vitamin A supplementaion

**ORGANISM INDICATION FOR THERAPY DOSAGE AND DURATION**

**OF TREATMENT**

|  |  |  |  |
| --- | --- | --- | --- |
| *Shigella* spp | WHO recommends  empiric antibiotics for all children in developing countries  with dysentery assuming that most cases are caused by  *Shigella.* | 1-5days up to 10 days in shig. Dysenteriae type 1 | • Ciprofloxacin\* 15 mg/kg/day PO bid × 3 days; OR  • Ceftriaxone 50-100 mg/kg/day IV or IM, qd × 3 days for severe illness requiring parenteral therapy; OR  • Azithromycin\* 12 mg/kg once on 1st day, then 6 mg/kg once daily on days 2 through 4 (total course: 4 days) |
| ETEC | Watery diarrhea in a traveler returning from an endemic  area that interferes with planned activities or is persistent | 1-5 days | Azithromycin 12 mg/kg once  on first day, then 6 mg/kg once  Ciprofloxacin 15 mg/kg/day  PO bid × 3 days |
| STEC | Avoid antimicrobials and anti-motility drugs |  |  |
| *Salmonella* ,  non-typhoidal | Antibiotics for uncomplicated gastroenteritis in normal  host are ineffective and may prolong excretion and are  not recommended  Treatment should be reserved for infection in infants  younger than 3 mo, and patients with immunocompromise, malignancy, chronic GI disease,  severe colitis hemolytic anemia, or HIV infection | 1-5 days | See treat. Of shigella  Patients without bacteremia can be treated orally for 5-7 days.  Patients with bacteremia (proven or until blood culture results are available in a high-risk host)  should be treated parenterally for 10-14 days |
| *Vibrio cholerae* O1  and O139 |  | 1-5 days | Antibiotics are not recommended for mild diarrhea that is  tolerable, is not distressing, and does not interfere with planned activities. When  empiric therapy is required abroad, azithromycin is suggested for young  children. Fluoroquinolones are recommended for older children and adults and  as second line therapy for younger children. Short-duration (3 days) therapy is  effective. |
| *Entamoeba*  *histolytica* | Treat the following conditions:  • Asymptomatic cyst excretors  • Mild to moderate intestinal disease  • Severe intestinal or extraintestinal disease (including liver  abscess) | 2-4 wks | *Asymptomatic cyst excretors:*  • Iodoquinol PO 30-40  mg/kg/day, max 2 g, divided tid × 20 days; OR  • Paromomycin PO 25-35  mg/kg/d divided tid × 7 days;  *Mild to moderate intestinal*  *disease and severe intestinal*  *or extra-intestinal disease:*  • Metronidazole PO 30-40  mg/kg/day divided tid × 7-10  days; OR  • Tinidazole PO 50 mg/kg, single  dose, max 2 g (for children ≥ 3  yr old) × 3 days, OR 5 days for severe disease  EITHER FOLLOWED BY  (to prevent relapse)  • Iodoquinol PO 30-40 mg/kg/day  tid × 20 days;  OR  • Paromomycin PO 25-35  mg/kg/day tid × 7 days |
| *Giardia*  *intestinalis* | Persistent symptoms | 1-4 wks | Tinidazole PO 50 mg/kg, single  dose, max 2 g (for children ≥ 3  yr old); OR  • Nitazoxanide PO; OR  – Age 1-3 yr: 100 mg bid × 3 days  – Age 4-11 yr: 200 mg bid × 3 days  – Age over 11 yr: 500 mg bid × 3 days  • Metronidazole PO 30-40  mg/kg/day divided tid × 7 days(max 250 mg per dose) |