DIARRHEA IN CHILDREN

Acute Watery Diarrhea:

DEFINITION:-

Diarrhea refers to the passage of loose or watery stools. The World Health Organization (WHO) defines a case as the passage of three or more loose or watery stools per day or a definite decrease in consistency and increase in frequency based upon an individual baseline.

ASSESSMENT OF A CHILD WITH DIARRHEA:-

The most important aspect of the management of a patient with diarrhea is to assess and classify the degree of dehydration but diarrhea and vomiting can be non-specific, presenting signs in children with systemic sepsis and other infections. A detailed history and thorough examination remain vital. The following points are specifically more important in history and examination of a child presenting with diarrhea.

(A) Important points in history:

- Diarrhea:
  - Number of days
  - Frequency of stools
  - Blood in stools
  - Vomiting: occasionally, frequently, vomits everything

- Feeding History:[breast feeding, bottle feeding]
- Local report of cholera outbreak
- Recent antibiotic or other drug treatment
- Attacks of crying with pallor in an infant

(B) Look for:

- Signs of dehydration & classify.
- Signs of severe malnutrition
- Abdominal distention
- Abdominal mass
- Signs of any systemic illness or sepsis

Assess & Classify Dehydration

The following table has been found very useful in correctly assessing and classifying the degree of dehydration;

Table: 1

SIGNS		No signs of Dehydration <3%	Some (moderate) Dehydration 3 – 8%	Severe Dehydration >8%
G	General Condition	Well, Alert	Restless, Irritable	Lethargic, Unconscious
E	Eyes	Normal	Sunken	Sunken
M	Mouth & Drinking	Normal	Thirsty, drink Eagerly	Poor or unable to drink
S	Skin pinch	Returns rapidly	Returns slowly	Very slowly >2 sec
Management of dehydration		**Plan A at Home**	**Plan B at Home or Center**	**Plan C in Hospital**

MANAGEMENT:

General Principles of Management:

1. **Prevention & treatment of Dehydration**
   (Hypo osmolar ORS **preferred** but if not available then standard ORS can be used)

Composition of Hypo osmolar ORS	
Na	75 mmol/L
K	20 mmol/L
Cl	65 mmol/L
Glucose	75 mmol/L
Citrate	10 mmol/L
Osmolarity	245 mmol/L

2. **Continue feeding**
3. **Zinc for 10 days**
4. **Follow-up**

ADVANTAGES OF HYPO OSMOLAR ORS:

- Less vomiting,
- Reduced stool output,
- Less risk of hypernatremia,
- Reduced need of I/V fluids.

(A) **Management of a child with NO Dehydration:-**

. Give extra fluids as much as the child will take
. Breast feed frequently and for longer
. In exclusively breastfed babies, give additional water & ORS.
. In infants >6 months, give one or more of the following, ORS, food based fluids (soup, rice water, yogurt drinks or clean water)
. Teach the mother how to prepare and give 2 packs of ORS for home treatment
. Give 10 ml/ kg ORS for each loose stool / vomiting.
. Give Zinc for 10 days.
. Follow up

(B) Management of a child with Some Dehydration:-

Deficit is 3 – 8 %, which should be replaced by 40 – 70 ml /kg of hypo osmolar ORS in 4 hours (see table)

1. Give frequent sips from cup or spoon every 1–2 minutes. (Child is better able to tolerate small amounts).

AGE	Up to 4 Months	4 Months Up to 12 Years	12 Months up to 2 years	2 years up to 5 years
WEIGHT	<6 Kg	6 - <10 Kg	10 - <12 Kg	12 - <19kg
ML	200 – 400	400 - 700	700 - 900	900 – 1400

2. If child vomits, wait for 10 minutes then continue more slowly, every 2 – 4 minutes.
3. Ongoing losses should be replaced by 10 ml/ kg per stool/ vomit.
4. If child's eyes become puffy, stop ORS and give plain water & continue feeding.
5. Continue breast feeding, but no other food for first 4 hours of rehydration therapy.
6. Give Zinc for 10 days.
7. Follow up.

Reassessment for dehydration:

(a) Reassess after 4 hours, if no dehydration then follow Plan **A**

(b) If some dehydration persists then repeat treatment for 4 hours with ORS, but now add food with other fluids as well.

(C) Management of a child with Severe Dehydration:-

Start Intravenous fluids immediately as follows:

Ringer Lactate **[preferred]** or Normal Saline 100ml/Kg

AGE	FIRST GIVE 30 ml/kg lN	THEN GIVE 70 ml/kg IN
INFANTS (Under 12 Months)	1 Hour	5 Hours
CHILDREN (12 months up to 5 years)	30 Minutes	2 ½ Hours

1. Reassess the child every 15–30 minutes, if not improving, give I/V fluids more rapidly
2. After initial bolus of IV fluid, give 50ml/kg of ORS in the next four hours, given that the child is able to drink, to complete rehydration.[and provide K]
3. Reassess after calculated amount of I/V fluids is given & treat accordingly, if severe dehydration persists, repeat I/V fluids as before. If signs of some dehydration then follow Plan **B** & if no dehydration then follow Plan **A**. Observe the child for 6 hours on oral hydration before discharge.
4. If IV access is not possible, Intraosseous route is a safe, simple & effective method of fluid and drug administration. If both routes are not available, then give ORS through NG tube as 20ml/Kg/hr for 6 hours.
5. Reassess every one to two hours.
6. Follow up.

MANAGEMENT OF SHOCK IN A CHILD WITHOUT MALNUTRITION

The management of shock has been dealt with separately as the fluid management is much different from that of a child presenting with severe dehydration.
Set up an intravenous line and draw blood for emergency laboratory investigation.
Infuse 20ml/kg as rapidly as possible (Normal saline or **Ringer lactate-preferred**)

AGE WEIGHT	VOLUME (20ml/kg)
2months (<4 kg)	75 ml
2- < 4 months (4-<6kg)	100 ml
4- <12 months (6-<10 kg)	150 ml
1-<3years (10-<14 kg)	250 ml
3- < years (14-19 kg)	350 ml

- Reassess after first infusion
  - If no improvement, repeat 20ml/kg as rapidly as possible
- Reassess after second infusion
  - If no improvement, repeat 20ml/kg as rapidly as possible
- Reassess after third infusion
  - If no improvement, repeat ringer's lactate or normal saline
- Reassess after fourth infusion

- If no improvement, follow disease specific treatment guidelines.

After improvement at any stage, shift to plan C

- Hospitalization as per assessment & need

MANAGEMENT OF SHOCK IN A CHILD WITH SEVERE MALNUTRITION

- CHILD SHOULD BE HOSPITALISED

1. Hydration

- Insert an intravenous line (& draw blood for emergency laboratory investigations)
- Weigh the child (or estimate the weight)to calculate the volume of fluid to be given
- Give IV fluid 15ml/kg over 1 hour. Use one of the following solution (in order of preference), according to availability:
  - Ringer's Lactate with 5% glucose (dextrose)
  - Half Normal saline with 5% glucose (dextrose)
  - Half strength Darrow's solution with 5% glucose (dextrose) or if these are unavailable
  -
  - Ringer's lactate

WEIGHT	VOLUME 15ml/kg	WEIGHT	VOLUME 15ml/kg
4 kg	60 ml	12 kg	180 ml
6 kg	90 ml	14kg	210 ml
8 kg	120 ml	16 kg	240 ml
10 kg	150 ml	18 kg	270 ml

- Measure pulse & breathing rate at start and every 5-10 minutes
- If there are signs of improvement (pulse & respiratory rate fall)
  - Give repeat IV 15ml/kg over 1 hour
  - Switch to oral NG rehydration with ReSoMal [OR hypo osmolar ORS] 10ml/kg/hour up to 10 hours

  - Initiate re-feeding:
    - **Breast feeding to continue**
    - **Other food to be withheld till hydration is achieved**
    - **Low lactose feeds: yoghurt, bannana, khichri**

- If child fails to improve after the first 15ml/kg IV, assume the child has septic shock
  - Give maintenance IV fluid (4ml/kg/hour) while waiting for blood
  - When blood is available, transfuse fresh whole blood at 10ml/kg slowly over 3 hours (use packed cells if in cardiac failure)
  - Initiate re-feeding with starter F-75
  - Start antibiotic treatment

- If child deteriorates during IV rehydration (breathing increased by 5 breaths/min or pulse by 15 beats/min), stop the infusion because IV fluid can worsen the child's condition

Intraosseous Infusion:-

In some instances, IV access is not possible. In this situation, intra-osseous infusion may be given. Intraosseous infusion is a safe, simple and reliable method of giving fluid and drugs in an emergency.

The 1st choice for the puncture is the proximal tibia. The site for needle insertion is in the middle of the antero-medial surface of tibia, at the junction of the upper & middle third to avoid damaging the epiphyseal plate. An alternate site for needle insertion is the distal femur, 2cm above the lateral condoyle.

NOTE: Stop the intraosseous infusion as soon as venous access is available. In any case, it should not continue for more than 8 hours.

Nasogastric Tube Rehydration:-

When oral intake is not possible , ORS may be given through N/G tube at 20 ml/ kg/ hour for 6 hours. Reassess every 1-2 hours & if abdominal distention or vomiting occurs, give fluids more slowly. If no improvement in 3 hours, send the child for I/V therapy.

2.Feeding during Diarrhea;

- ✓ Start feeding in children >6 months before discharge.
- ✓ Instruct mother to offer food 5-6 times/day & encourage child to eat
  e.g., Cereal or starchy food mixed with pulses, vegetables, meat/fish with 1- 2 spoon of oil. Traditional diet found effective in diarrheoa like khichri, yogurt, and banana is to be encouraged.

Feeding after Diarrhea:
Give one extra meal/ day for 2 weeks.

3. Zinc: Up to 6 months: 10 mg/day x 10 days
6 months onwards: 20 mg/day x 10 days

4. Antibiotics

Antibiotics are not routinely recommended for AWD

- Most episodes are caused by viruses
- Most episodes are self limiting including those caused by bacteria
- Are likely to select for antibiotic resistance
- Might promote bacterial overgrowth
- Consider antibiotics only for specific etiology/organism

If antibiotics are required, local sensitivity pattern shall be followed

5. **Probiotics:**

Probiotics are not recommended for routine use, for prevention or treatment of AWD. Further research is needed to determine the optimal type, dosage and regimen.

6. **Follow-up**

Ask mother to come back immediately if

- Child becomes more sick
- Unable to drink or breast feed
- Develop fever
- Blood in stool

If none of the above signs are present but the child is not improving, ask her to come back after 5 days.

RECOMMENDATIONS FOR ADMISSION

- Severe dehydration
- Some dehydration – (Day care for six hours)
- Young infants <6 months, consider admission, if
    - Frequency of stools >8/ 24 hours
    - Persistent vomiting >4/ 24 hours
- Oral route is not available
- Unable to manage at home
- Malnutrition or any other severe condition (eg: Severe Pneumonia or Sepsis)

INDICATIONS FOR INTRAVENOUS USE

- Uncontrollable vomiting
- Severe continuous losses in diarrhoea , purging rate more than 10 ml/ Kg / hour in two consecutive four-hour period or more than eight bowel movement in last eight hours with watery content
- Inability to use oral route (fatigue, inability to drink, mouth lesions, abdominal distention, and or has severe disease)

INDICATIONS FOR INVESTIGATIONS

- Severe dehydration with circulatory collapse
- Some dehydration with a doughy feel to the skin

- Some dehydration in cases whose history and/or physical findings are inconsistent with straight forward diarrheal episodes.
- Children on I/V fluids/ antibiotics

Recommended Investigations

1. Urea & Electrolytes, CBC
2. Blood culture & sensitivity, when sepsis suspected

3. Stool (Microscopy& C/S)*
4. Stool Virology *****

***** Should be encouraged in all for collection of data, where possible.

DYSENTRY

Indications for Admission:-

1. Child with severe malnutrition.
2. Less than 2 months old.
3. Children who are toxic, lethargic, have abdominal distention or tenderness.

Management:-

1. Rehydrate according to degree of dehydration.
2. Antibiotics according to local sensitivity pattern.
3. Feeding
4. Zinc supplement

Feeding:-

Ensuring a good diet is very important as dysentery has a marked adverse effect on nutritional status. However, feeding is often difficult because of lack of appetite. Return of appetite is an important sign of improvement.

- Breast feeding should be continued throughout the course of illness, More frequently than normal, if possible, because the infant may not take the usual amount per feed.
- Children aged 6 months or more should receive their normal foods.
- Encourage the child to eat & allow the child to select preferred foods.

Zinc supplement:-

Upto 6 months 10 mg/day x 10 days
6 months onwards 20 mg/day x 10 days

Follow up:-
Follow up children after 2 days, look for signs of improvement such as no fever, fewer stools with less blood , improved appetite.

- Is there no improvement after 2 days.
  - Check for other conditions
  - Stop the first antibiotic, and
  - Give the child a second-line antibiotic which is known to be effective against Shigella in the area.

- If the two antibiotics, which are usually effective for Shigella in the area, have each been given for 2 days and produced no signs of clinical improvement.

  - Check for other conditions.
  - Admit the child if there is another condition requiring hospital treatment.
  - Otherwise treat as an outpatient for possible amoebiasis.
  - Give the child metronidazole (10 mg/kg, 3 times/ day) for 5 days, and in severe cases, for ten days.

PERSISTENT DIARRHOEA
DEFINITION:
Diarrhoea which starts like acute watery diarrhea and persists for more than two weeks.
Persistent diarrhoea is further classified into two types:

Diarrhoea without dehydration → **Persistent Diarrhoea**
Diarrhoea with dehydration →→**Severe Persistent Diarrhoea**

Management:

ADMIT IF:
Severe persistent diarrheoa
Malnutrition with any persistent diarrheoa**;**

Management of Persistent Diarrhoea:

- **Four basic principles;**
- Loses replaced by appropriate fluids
- Feeding :[proper dietary management & wt gain are most important]should be continued
- Avoid unnecessary medications
- Treat evidence based chronic conditions

- Assess for dehydration & manage according to the degree of Dehydration and use
  - Plan **A** [No dehydration]
  - Plan **B** [Some dehydration]
  - Plan **C** [Severe dehydration]

- ORS is generally effective. However, impaired glucose absorption may occur, which may aggravate diarrheoa. In such cases, i/v fluids can be given.

Dietary Management: Give other foods appropriate for the child's age to ensure an adequate caloric intake. Give frequent small meals, at least 6 times a day. Reduce lactose by decreasing the amount of non-human milk in the diet.

- Replacement of Cow's milk by fermented milk products such as
  1- Yogurt which contains less lactose, is one way to reduce the intake of lactose. (2 parts of milk & 1 part of yogurt)
  2- Khichdi [Lentils + Rice]

- DIET: Starch base/ reduced milk concentration
  Low lactose 100 Kcal/ 100 gm

  Less lactose 3.7 grams lactose/ kg/ day

  10% Protein

  Full fat dried milk 11gm + Rice 15gm + Vegetable oil 3.5gm + Cane sugar 3 gm + Water 200ml

Children who do not recover on the initial diet (low lactose diet) can be switched over to a second, milk free diet which contains no milk such as a diet based on rice mixed with a protein source e.g. chicken or egg white.

Milk free diet (Lactose free)

- 70% cal per 100 grams
- 10% calories as protein
- Whole egg 64 gms or Finely grounded chicken 12 gms
- Rice 3 gms
- Vegetable oil 4 gms
- Glucose 3 gms
- Water 200 ml

Zinc:- Upto 6 months 10 mg/day x 10 days
6 months onwards 20 mg/day x 10 days

Zinc supplements even during an acute diarrhea reduce the duration and severity of the disease and prevent subsequent episodes of diarrhea. Studies shows that 10 -20 mg of zinc for 14 days reduced the number of episodes of diarrhea within 2 – 3 months after the supplementation regimen.The incorporation of zinc supplement reduces the duration of acute diarrhea by 25% duration of persistent diarrhea by 29% and treatment failure or death in persistent diarrhea by 40%.

Follow up:-

- Ask the mother to bring the child back for re-assessment after 5 days, or earlier if the diarrhoea worsens or other problems develop.
- Fully reassess children who have not gained weight or whose diarrhoea has not improved in order to identify any problems, such as dehydration or infection, which need immediate attention or admission to hospital. Those who have gained weight and who have less than three loose stools per day may resume a normal diet for their age.

TREATMENT OF DEHYDRATION IN MALNUTRITION

Do not use the I/V route for rehydration except in cases of shock. Standard WHO-ORS solution for general use has a high sodium and low potassium content, which is not suitable for severely malnourished children. Instead, give special rehydration solution for malnutrition, ReSoMal*****

***Recipe for ReSoMal**

Ingredient	Amount
Water	2 liters
WHO-ORS	One 1-liter packet*
Sucrose	50 g
Electrolyte/mineral solution**	40 ml

* 2.6 g sodium chloride, 2.9 g trisodium citrate dihydrate, 1.5 g potassium chloride, 13.5 g glucose.

** Formula for concentrated electrolyte/mineral solution

	g	mol/20ml
Potassium chloride: KCl	224	24 mmol
Tripotassium citrate	81	2 mmol
Magnesium chloride	76	3 mmol
Zinc acetate	8.2	300 µmol
Copper sulfate	1.4	45 µmol
Water	2500 ml	

- Give the ReSoMal rehydration fluid, orally or by Naso-gastric tube, much more slowly than you would when rehydrating a well-nourished child:
  - Give 5 ml/kg every 30 minutes for the first 2 hours.
  - Then give 5 – 10 ml/kg/hour for the next 4 – 10 hours.

The exact amount depends on how much the child wants, volume of stool loss, and whether the child is vomiting.

- If rehydration is still occurring at 6 hours & 10 hours, give starter F-75 instead of ReSoMal of these times. Use the same volume of starter F-75 as for ReSoMal.

ReSoMal as such is not commercially available even the ingredients to make one are not easily available, the use of low osmolar ORS instead can be used with similar efficacy.

ANTIMICROBIAL THERAPY FOR ACUTE INFECTIOUS DIARRHEA

THE FOLLOWING ANTIBIOTICS ARE RECCOMMENDED FOR THE SPECIFIC ETIOLOGIES:

ORGANISM	DRUG OF CHOICE	ALTERNATE CHOICE
Shiegella sp	**Cefixime** (O)x5D or **Ciprofloxacin** (O)x3-5D	Nalidixic acid (O)x5D
NT Salmonella	**Uncomplicated NTS:**	No antibiotic
	NTS Septicemia: Ciprofloxacin (O) or 3rd Generation Cephalosporin IV	
Vibrio cholera	**In children > 9years**	
	Tetracycline (O) x 3D or Doxacycline (O) x 3D	Furazolidine (O) x 5D
	In children < 9years	

Erythromycin (O) x 5D
or
Ciprofloxacin (O) x single dose

Compylobacter Sp	Erythromycin (O) x 7D	or	Ciprofloxacin (O) x 5D

Clostridium Difficile	Metronidazole (O) x 7-10d Vancomycin (O) x 7-10d

DRUG	**DOSE**	**FREQUENCY**
Ceftrioxone	50-70mg/kg/day	OD
Ciprofloxacin	20-30mg/kg/day	12 hourly
Tetracycline	50mg/kg/day	6 hourly
Doxycycline	5mg/kg/day	OD
Erythromycin	40mg/kg/day	6 hourly
Azithromycin	10mg/kg/day	OD
Metronidazole	20-40mg/kg/day	8 hourly
Vancomycin	25-40mg/kg/day	6 hourly

PREVENTION OF DIARRHEOA:

- Exclusive breast feeding be strongly advocated and encouraged
- Proper sanitation and clean water supply can reduce incidence of diarrhea
- Public awareness for hygiene
- HAND WASHING is most important measure to prevent diarrhea
- Strongly discourage use of bottles
- Encourage parents to boil water for drinking
- Vitamin A with polio drops
- Measles vaccination

PARENTAL COUSELLING:

Discuss preventive measures
Nutrition & weight gain
Use of ORS and recognition of danger signs to prevent mortality

FURTHER READINGS:

1 Evidence- Based Paediatric Infectious Diseseases by David Isac ed. 2007
2 Pocket book of Hospital care for children by WHO. 2006