In the name of GOD

Diarrhea in Pediatrics

Introduction:

- Leading cause of childhood morbidity & mortality in developing countries
- Important cause of malnutrition
- 80% of deaths due to diarrhoea occur in the first two years of life.
- Children <3 years of age in developing countries experience around three episodes of diarrhoea each year.

Definition

In epidemiological studies diarrhoea is defined as:

Passage of three or more loose or watery stools in a 24-hour period, a loose stool being one that would take the shape of a container.

Definition

In Pediatrics,

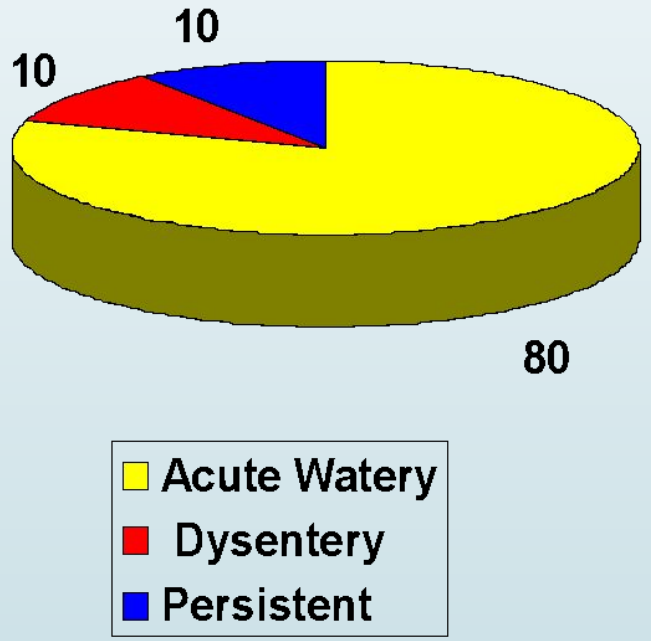
Diarrhoea is an *increase* in the:

- Fluidity
- Volume
- Number

of stools relative to the usual habits of each individual.

Types of Diarrhoea

- *Acute watery diarrhoea*
- *Dysentery*
- *Persistent diarrhoea*



Acute Watery Diarrhoea

- **Constitutes 80% of cases of diarrhoea**
- **Begins acutely, lasts less *than 14 days* (most episodes last less than 7 days),**
- **Involves passage of frequent loose or watery stools *without* visible blood.**
- **Vomiting may occur,Fever may be present**
- **Main sequelae:**
  - **Dehydration that can be fatal**
  - **Contributes to malnutrition**

Dysentery (Bloody Diarrhoea)

- **Constitutes 10% of cases of diarrhoea**
- **Diarrhoea with *visible red blood* in the stools**
- **Main sequelae:**
  - **Anorexia**
  - **Rapid weight loss**
  - **Damage to the intestinal mucosa**

Persistent Diarrhoea

- Constitutes 10% of cases of diarrhoea
- Diarrhoea that *begins acutely* as watery diarrhoea or as dysentery and lasts for *14 days or more*.
- Should not be confused with *chronic* diarrhoea which is recurrent or long-lasting diarrhoea due to noninfectious causes.

Toddler diarrhea

- The most causes of loose stool is toddler diarrhea
- Normal Weight and development
- Excessive Consumption of sweet disaccharide(oral beverage)
- Stop diarrhea with decrease and change oral beverage

Etiology of Diarrhoea

- The majority of diarrhoeas occur as a result of infection with a *few* pathogens which tend to recur again and again.
- The most important causes of acute diarrhoea in developing countries are:
  - Rotavirus
  - Enterotoxigenic *Escherichia coli*
  - *Shigella*
  - *Campylobacter jejuni*
  - *Cryptosporidium*

Type/Frequency	Infant	Child	Adolescent
		ACUTE	
Common	Gastroenteritis*	Gastroenteritis*	Gastroenteritis*
	Systemic infection	Food poisoning	Food poisoning
	Antibiotic-associated	Systemic infection	Antibiotic-associated
	Overfeeding	Antibiotic-associated	
Rare	Primary disaccharidase deficiency	Toxic ingestion	Hyperthyroidism
	Hirschsprung toxic colitis		
	Adrenogenital syndrome		
		CHRONIC	
Common	Postinfectious secondary lactase deficiency Cow's milk/soy protein intolerance Chronic nonspecific diarrhea of infancy (toddler's diarrhea) Celiac disease Cystic fibrosis	Postinfectious secondary lactase deficiency Irritable bowel syndrome Celiac disease Lactose intolerance Giardiasis	Irritable bowel syndrome Inflammatory bowel disease Lactose intolerance Giardiasis Laxative abuse (anorexia nervosa)
	AIDS enteropathy	Inflammatory bowel disease	
Rare	Primary immune defects	AIDS enteropathy	AIDS enteropathy
	Familial villous atrophy	Acquired immune defects	Secretory tumors
	Secretory tumors	Secretory tumor	Primary bowel tumor
	Congenital chloridorrhea	Pseudo-obstruction	
	Acrodermatitis enteropathica	Factitious	
	Lymphangiectasia		
	Abetalipoproteinemia		
	Eosinophilic gastroenteritis		
	Short bowel syndrome		
	Intractable diarrhea syndrome		
	Autoimmune enteropathy		
	Factitious		

The following questions may be helpful.

1) When did the current problem start?
2) How many bowel movements per day?
3) What is the normal pattern for this child?
4) Are the loose movements interspersed by normal ones?
5) Has the child ever experienced this before?
6) What is the child's dietary history (rule out overfeeding)?

1. What is the consistency of the stool?
2. What is the volume of stool that the child is passing?
3. Is there blood or pus contained within the stool?
4. Is it extremely foul-smelling or contain oil droplets (malabsorption)?
5. Bloody diarrhea may suggest specific infectious agents, inflammatory bowel disease, bowel ischemia (or necrotizing enterocolitis) or cow's milk protein allergy.

1. Does the child have a fever?
2. Has the child also been vomiting (very common and can exasperate dehydration)?
3. What is the child's current urine output (oliguria or anuria suggests a large volume deficit)?
4. Has the child been able to take in any fluids?
5. Do we have records of the child's weight (useful to compare these to the current to assess the degree of dehydration)?

1. Is the child immunocompromised (if yes, think unusual infections)?
2. Has the child been exposed to anyone else with a similar illness?
3. Has the child been institutionalized? Has there been any travel or has the child newly immigrated?
4. Has there been any recent use of antibiotics?
5. Are there any other concurrent problems or pertinent past medical history?

Assessment of Dehydration

4 Important Signs:

- Sensorium(lethargic OR restless OR normal)
- Sunken Eyes (ask caretaker as well)
- Drinking (poorly OR eagerly OR normally)
- Skin Pinch (very slowly OR slowly OR immediately)
  - Pinched in longitudinal manner
  - Pinched between the thumb and the bent fore-finger

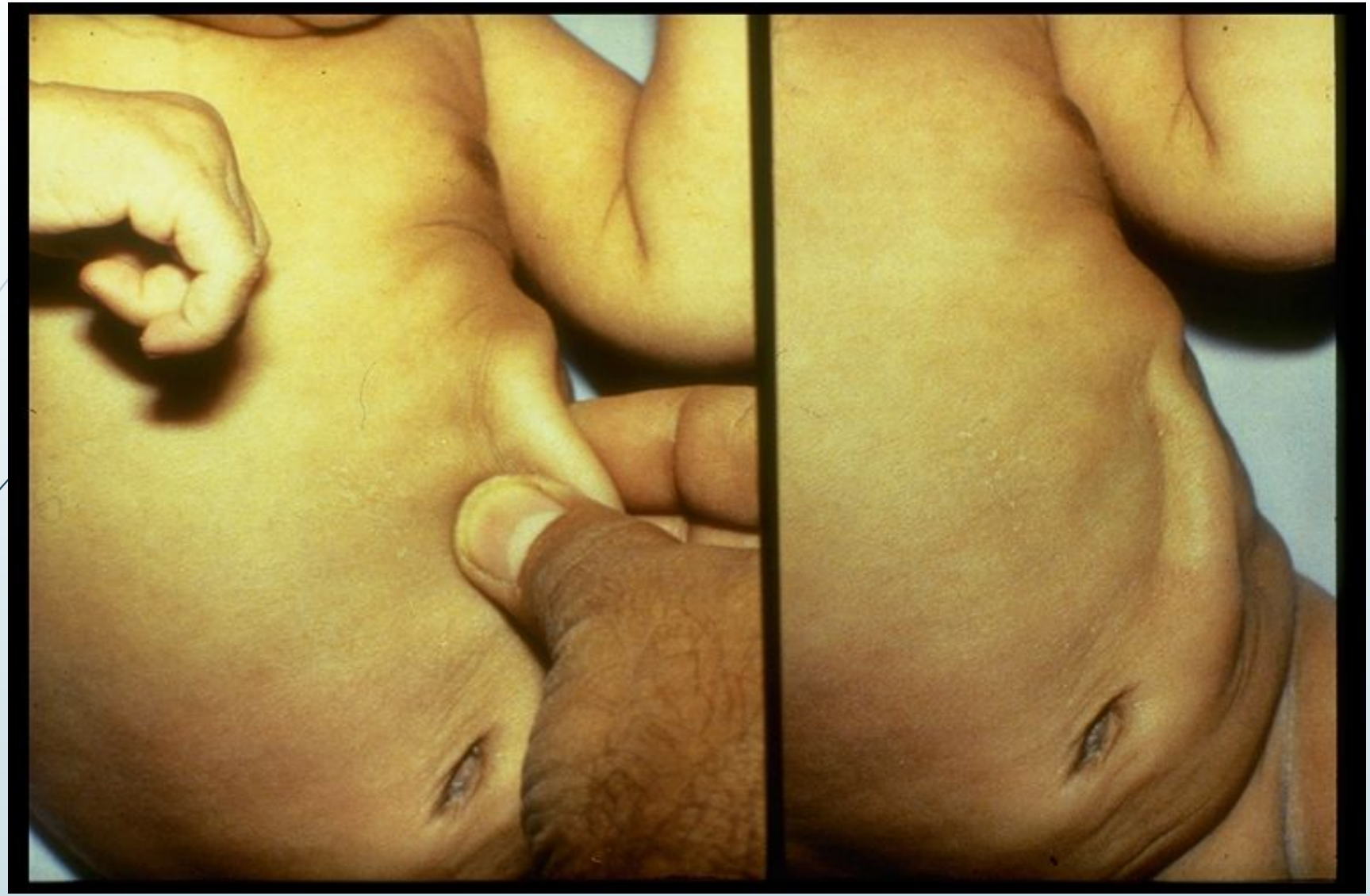
condition	Well alert	restless, irritable	Lethargic, floppy
eyes	normal	sunken	Very sunken
tears	+nt	-nt	-nt
Mouth&tongue	moist	dry	Very dry
thirst	Drink normally not thirsty	Drink eagerly, thirsty	Drink poorly, Not able to drink
Skin pinch	Goes back quickly	Goes back slowly	Goes back very slowly
	No dehydration	*Some dehydration*	*Severe dehydration*

Unconscious child


Lethargic child


Sunken
Eyes


Thirsty, Drinking eagerly



Skin Pinch returns Very Slowly (> 2 seconds

Physical exam :

(a)*Vitals*- Heart rate and blood pressure are key predictors of dehydration.

Tacchycardia with a low blood pressure indicates severe hypovolemia and should be corrected immediately.

Hypotension is a late finding in the child with hypovolemia.

Fever suggests infection (always record the child's temperature).

Weak pulses support the finding of dehydration.

(b)*Change in Weight*- If you have records of previous weight, this allows you to accurately stimate the volume deficit.

(c) *Mental status*- Alert , restless ,lethargic,

(d)*Mucous Membranes*- Determine if these are moist or dry. Check inside the mouth rather than the lips Remember that sunken eyes and/or the absence of tears also suggest dehydration.

(e)*Anterior Fontanelle*- In infants, a flat or sunken fontanelle is also an indicator of dehydration. Fontanelles should be assessed in the sitting and not the supine position.

(f)*Skin Turgor*- Gently pinch and release the skin over the abdomen to assess if the turgor is normal or decreased. Slow retraction is a sign of moderate dehydration whereas “tenting” (the lack of retraction) implies severe dehydration and should be taken very seriously. In a normal, hydrated child, the skin should retract immediately.

(g)*Capillary Refill*- If the capillary refill is delayed to more than 2 seconds

(h) *Urine Output*- Normal output is approximately 1-2 mL/kg/hr. In infants, you can estimate output from the number of wet diapers/day.

: Laboratory investigations

- Serum electrolytes should be performed on any child with significant volume depletion.
- Screen for poor kidney function with Urea and Creatinine.
- Obtain a complete blood count with differential count for evidence of 1) infection (abnormal WBC or differential), 2) dehydration (hemoconcentration), 3) anemia and or thrombocytopenia in HUS.

Laboratory investigations

- Stool cultures should be considered in all febrile children with diarrhea.
- Stool Ovum and Parasite investigation can be ordered for children who have traveled to any endemic areas.
- Viral antigen tests (Adeno and Rotavirus PCR) of stool can be used to distinguish viral from bacterial causes (remember Rotavirus is the most common cause of diarrhea in North America)
- A urinalysis should be considered as UTI's commonly occur with diarrhea, either as cause or as consequence.
- Blood cultures should be ordered if sepsis is a concern.

Treatment And Medication:

Advantages of ORS

- **Oral**
- **One solution**
- **Useful for all types of dehydrations**
- **All Ages**
- **Safe**
- **Available**
- **Cheap**
- **Simple to use**

ORT

- ORT is the cornerstone of treatment, especially for small-bowel infections that produce a large volume of watery stool output.
- ORT with a glucose-based oral rehydration syndrome must be viewed as by far the safest, most physiologic, and most effective way to provide rehydration and maintain hydration in children with acute diarrhea worldwide.
- Administer maintenance fluids plus replacement of losses.
- Administer small amounts of fluid at frequent intervals to minimize discomfort and vomiting.
- Once the child becomes better hydrated, cooperation improves enough to take small sips from a cup. Oral rehydration is now universally recommended to be completed within 4 hours.

Fluid Therapy

HOW GIVEN :

- Oral Route is Preferable
- Intravenous is used ONLY if :
  - Uncontrollable vomiting
  - Severe continuous losses in diarrhea
  - Inability to use oral route (fatigue, inability to drink , mouth lesions, etc.)

Oral Subsequent Fluid Therapy

- Maintenance Fluids:

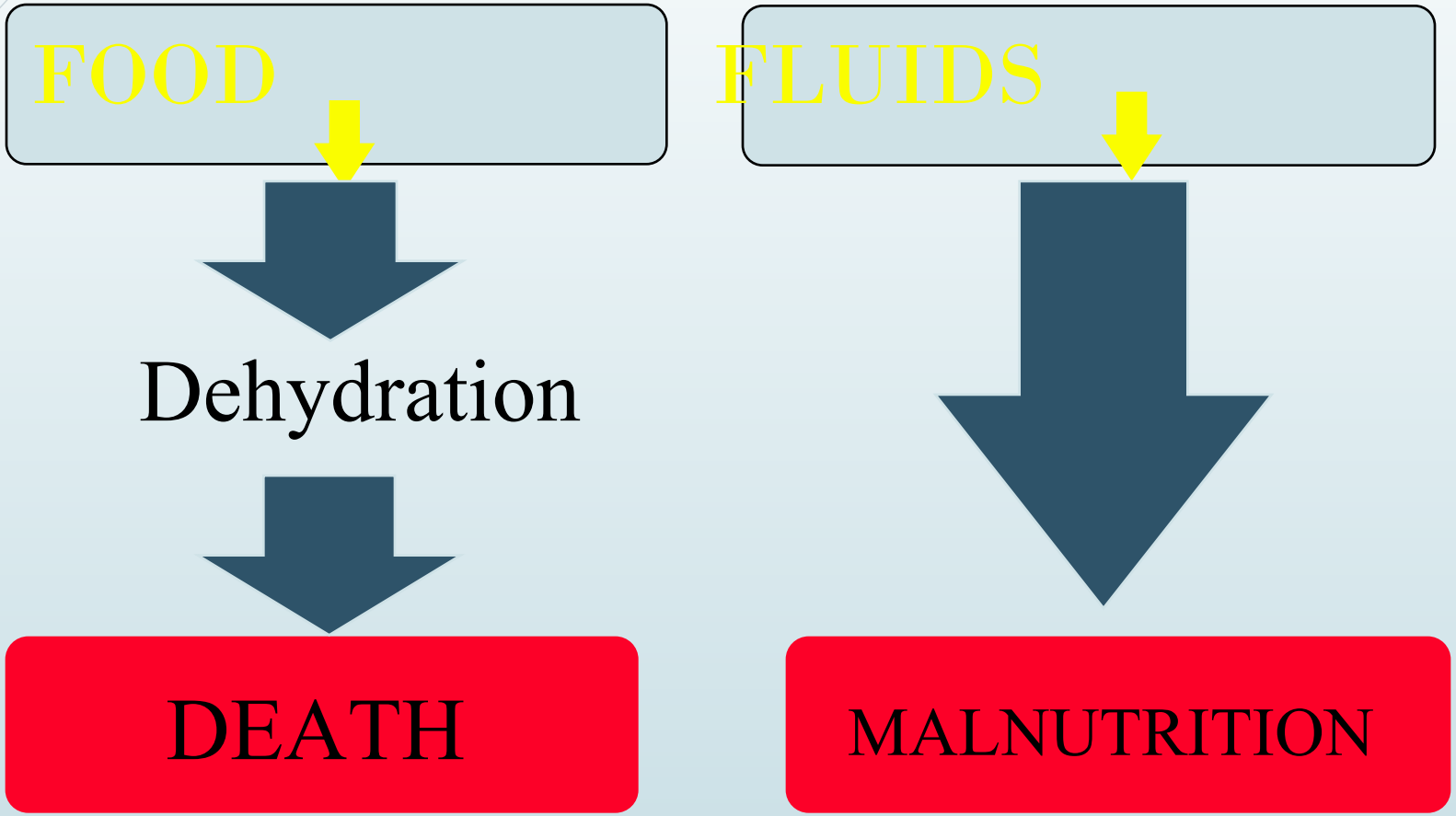
  Give "Normal" Foods & Drinks (No need for calculations)

- On-going losses:

  After Each Loose Stool:

  - Age < 1 y : **50 - 100** ml (1/4 - 1/2 Cup)
  - Age > 1 y : **100-200** ml (1/2 - 1 Cup)

Main Dangers of Diarrhea:



Diarrhea : Lines of treatment

- Fluids
- Food
- Further management
- Follow up

Management of Dehydration

SIGNS		No signs of dehydration	Some (mod.) dehydration	Severe dehydration
G	General condition	well, alert	restless, irritable	lethargic, unconscious
E	Eyes	normal	sunken	sunken
M	Mouth & Drinking	normal	thirsty, drink eagerly	poor or una-ble to drink
S	Skin pinch	returns rapidly	returns slowly	very slowly
Management of dehydration		**Plan A at Home**	**Plan B At OR Center**	**Plan C At Hospital**

For Each Plan of Management:

- FLUID THERAPY:
  - Different for each plan
- FEEDING:
  - Similar for all plans

Initial Fluid Therapy

- **Amount:**
  - No Signs of dehydration (mild): >50 ml/ kg
  - Some (moderate) dehydration: 75 (50-100)ml/kg
  - Severe dehydration: >100 ml/kg
- **How Given:**
  - Oral route: for "No dehydration"
  - Oral or NGT: for "Some dehydration"
  - Intravenous: for "Severe dehydration" or failure of oral or NGT rehydration

Plan **A**: Fluid Therapy

- *Home fluids for diarrhea*
- Home fluids must be:
  - Safe when given in large volumes
  - Easy to prepare
  - Acceptable color and palatability
  - Effective in preventing dehydration

Plan **A**: Fluid Therapy

- *Home fluids for diarrhea*
- Ideal home fluids should contain:
  - salts and nutrients (sodium, potassium, chloride, and bicarbonate)
  - calories to replenish diet

Plan A: Fluid Therapy

- *Home fluids for diarrhea*
- Examples of home fluids:
  - ORS solution
  - Soup (salted or unsalted)
  - Yoghurt-based drinks
  - Breast milk
  - Cereal water
  - Plain clean water
  - Fresh fruit juice
  - Weak herbal tea

Plan **A**: Fluid Therapy

The child is brought to Health Center if:

- Repeated vomiting
- Diarrhea gets worse (frequent large stools)
- Blood in the stools
- Increased thirst
- Failure to eat and drink normally
- Fever

Plan **B**: Fluid Therapy

- Type of Fluid : O R S
- Amounts:

  50-100 ml (± **75 ml**) / Kg of body weight
- How given:

  SLOWLY (1 spoon / 1-2 min) for 4-6 hours

  By Cup & spoon, Cup alone, Dropper,

  Syringe or by Nasogastric Tube (NGT)

Plan **B**: Fluid Therapy

Assessment of progress of Rehydration:

Reassess after 4 hours

- **If NO Signs of Dehydration:**
  - Shift to Plan **A**: Food-based Fluids, feeding
- **If NO Improvement (i.e: still "some" dehydr):**
  - Repeat Plan **B** (ORS + Feeding)
- If Worsening, i.e. Severe Dehydration:
  - Shift to Plan **C** : I.V. Fluids then feeding

Problems during Oral Rehydration

- Puffy Eyes = Overhydration.
  - Stop ORS, Give breast-feeding or Water
- Refusal of ORS:
  - If NO Signs of Dehydration: Shift to Plan **A**
  - If sill “Some” Dehydration: Give ORS by **NGT**
- Vomiting:
  - Wait 10 minutes then give ORS at slower rate
  - Use NGT to give ORS, or
  - Shift to Plan C (intravenous rehydration)

Plan **C**: Fluid Therapy

- Type of Fluid : for ALL types of dehydration

Normal saline, Ringer's lactate

- Amounts:

  ± 100 ml / Kg of body weight.

- How given:
- **For infant<12months**
  - 1/3 (**30** ml/kg): rapidly in - **1** hour
  - 2/3 (**70** ml/kg): slowly in - **5** hours

For infant >12months

1/3 (**30** ml/kg): rapidly in – **30 minutes**

2/3 (**70** ml/kg): slowly in – **2:30** hours

Assessment of Progress of Plan **C**:

Check hourly for:

- Return of Strong Pulse
- Improvement of Consciousness
- Improvement of Skin turgor
- Passage of Urine
- Give ORS(5ml/kg/hour)as soon as(3-4hours for infant and 1-2 hours for child)

Progress of I.V.Rehydration Therapy

- If NO Improvement (i.e: severe dehydr):
  - Repeat Plan C (I.V. Fluid therapy)
- If there is still “Some” Dehydration:
  - Start Plan B : ORS, feeding
- If NO Signs of Dehydration:
  - Start Plan A: Food-based Fluids, feeding, etc.

Mild-to-moderate dehydration

- Rehydration therapy :

Oral rehydration solution (50-100 mL/kg over 3-4 h)

- : Replacement of losses

Less than 10 kg body weight 50-100 mL oral rehydration solution for each diarrhea stool or vomiting episode

More than 10 kg body weight 100-200 mL oral rehydration solution for each diarrhea stool or vomiting episode

:

Severe dehydration

- Rehydration therapy :

Intravenous lactated Ringer solution or normal saline (20 mL/kg until perfusion and mental status improve), followed by 100 mL/kg oral rehydration solution over 4 hours or 5% dextrose (half normal saline) intravenously at twice maintenance fluid rates

- : Replacement of losses

Less than 10 kg body weight 50-100 mL oral rehydration solution for each diarrhea stool or vomiting episode

More than 10 kg body weight 100-200 mL oral rehydration solution for each diarrhea stool or vomiting episode

Feeding during and after Diarrhea

Feeding during & after Diarrhoea

- During Diarrhea:
  - Give as much as the child wants
  - Give small frequent feeds (every 3-4 hours)
  - Encourage anorexic child to eat
- After Diarrhea stops:
  - Continue feeding the child as usual
  - Give one extra meal/day for 3-4 weeks

For Breast-fed

Continue breast feeding as usual during and after rehydration therapy

For Formula-fed

- Continue same formula and same concentration
- Low lactose of Lactose-free formula **ONLY** in case of 2^{ry} lactose intolerance (rotavirus)

Children on Mixed Diet

- Continue normal feeding as usual
- Give repeated small frequent feeds (every 3-4 hours)
- Avoid sweetened foods
- Avoid foods containing a lot of fibers
- Avoid foods known to have a laxative effect

Types of Drugs

- **Antimicrobials**
  - **Antibiotics**
  - **Antiparasitic**
- **Antidiarrheal agents**
  - **Antimotility agents**
  - **Adsorbents**
- **Antiemetics**

Rational Use of Drugs

- Antibiotics: ONLY for Cholera & Dysentery
- Antiparasitics: Ent. Histolitica trophozoites, Giardia intestinalis
- Antidiarrheals: Not recommended
- Antiemetics: Not recommended

ANTIMOTILITY AGENTS

EFFECTS

- May decrease number of stools
- NO effect on amount of stools/ day
- NO effect on fluid loss in stools

ADVERSE EFFECTS

- Drowziness Coma Death
- Abdominal distension → Ileus →
- N.E.C., Toxic megacolon →

DANGEROUS, NOT USED FOR CHILDREN

ANTIMOTILITY AGENTS

- **Diphenoxylate HCl.**

  Synthetic pethidine + Atropine

- **Loperamide**

  Synthetic opiate analogue

Mechanism of Action:

Inhibit propulsive motor activity of intestine

ADSORBENTS

- **Activated Charcoal (antidote)**
- **Prepared Chalk** ***(Ca.Carbonate)***
- **Bismuth Subcarb.& Subgallate**
- **Kaolin** ***(aluminium Silicate)***
- **Attapulgite** ***(alum.+ Mag. silicate)***
- **Pectin** ***(carbohydrate)*** **: ABSORBED**
- **Plantagel (herbal medicine)**

ADSORBENTS

- IMPROVE STOOLS CONSISTENCY:
  - ? Protective coat on mucosa
  - ? Adsorb bacterial toxins
  - ? Bind bile acids
  - ? Alter bacterial flora
- NO EFFECT ON STOOL VOLUME
- SOME EFFECT ON STOOL NUMBER
- MAY BIND: electrolytes, fats, drugs

NOT COST EFFECTIVE

ANTIEMETICS

- Hyoscine (for motion sickness)
- Antihistamines (motion sickness)
- Metoclopramide (CTZ + ↑ motility)
- Domperidone (CTZ + ↓ motility)
- Chlorpromazine (depress CTZ)
- B6 ???

ANTIEMETICS

- **Sedation & interfere with ORS intake**
- **Serious neurological complications**
- **Some of them may hurry GIT motility**

VOMITING IN DEHYDRATED CHILD USUALLY STOPS AFTER REHYDR. & CORRECTION OF ACIDOSIS

The addition of zinc to oral rehydration solution

- Zinc has been proven effective in children with acute diarrhea in developing countries and is recommended by the WHO for 10-14 days.
- 10 mg/day for infants<6 months
- 20mg /day for infants >6months

- However, no evidence suggests efficacy in children living in developed countries, in which the prevalence of zinc deficiency is assumed to be extremely low.