



ACUTE GASTROENTERITIS IN CHILDREN

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ACUTE GASTROENTERITIS

Definition

ACUTE GASTROENTERITIS

It is an infection of the gastrointestinal tract caused by bacteria, viruses and parasites.

It covers infections that cause diarrhea.

Diarrhea is loose, watery stools three or more times a day (≥ 3 defecations/day).

It usually takes less than a week.

It is not expected to last more than two weeks.

ACUTE GASTROENTERITIS



ACUTE GASTROENTERITIS

Etiology

<i>Bacteria (~%15)</i>	<i>Viruses (~%75)</i>	<i>Parasites (~%5)</i>
<i>Aeromonas spp.</i> <i>Bacillus cereus</i> <i>Campylobacter jejuni</i> <i>Clostridium perfringens</i> <i>Clostridium difficile</i> <i>Escherichia coli</i> <i>Plesiomonas shigelloides</i> <i>Salmonella spp.</i> <i>Shigella spp.</i> <i>Staphylococcus aureus</i> <i>Vibrio cholerae</i> <i>Vibrio parahaemolyticus</i> <i>Yersinia enterocolitica</i>	Astroviruses Caliciviruses Enteric adenovirüs Herpes simplex viruses Norovirus Rotavirus Cytomegalovirus	<i>Balantidium coli</i> <i>Blastocystis hominis</i> <i>Cryptosporidium parvum</i> <i>Cyclospora cayetanensis</i> <i>Encaphalitozoon intestinalis</i> <i>Entamoeba histolytica</i> <i>Enterocytozoon bienersi</i> <i>Giardia lamblia</i> <i>Isospora belli</i> <i>Strongyloides stercoralis</i> <i>Trichuris trichiura</i>

ACUTE GASTROENTERITIS

Transmission

ACUTE GASTROENTERITIS

Fecal-oral route

Contaminated water and food

ACUTE GASTROENTERITIS

Microorganisms that can be transmitted from person to person with a small amount of inoculum.

Shigella

Escherichia coli

Norovirus

Rotavirus

Giardia lamblia

Cryptosporidium parvum

Entamoeba histolytica

ACUTE GASTROENTERITIS

Epidemiology

EPIDEMIOLOGY

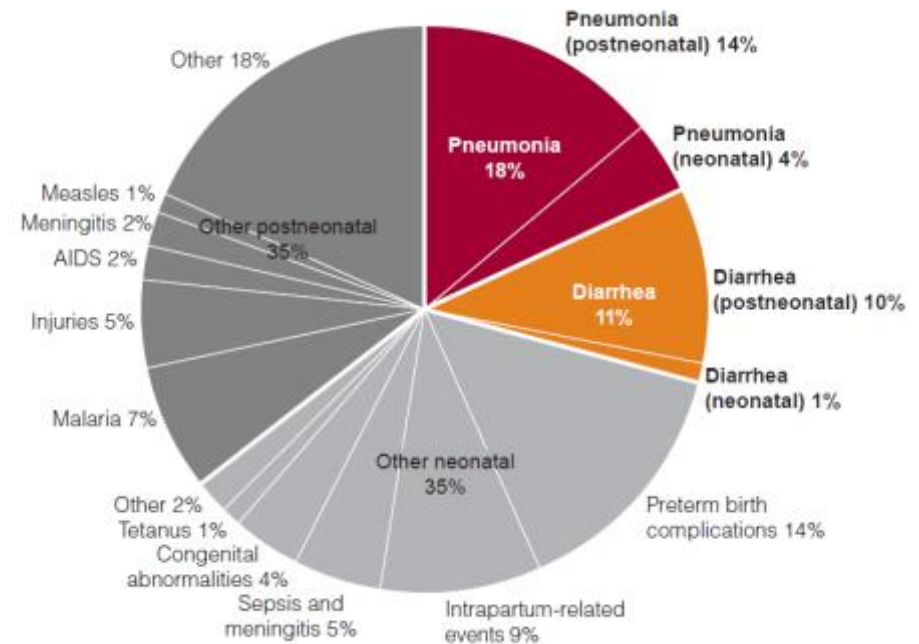
It is an important cause of morbidity and mortality under the age of 5 in underdeveloped countries.

In underdeveloped countries, 3-6 attacks occur per year.

It causes about 1.5-2 million deaths per year.

It is the second most common cause of child death.

EPIDEMIOLOGY



ACUTE GASTROENTERITIS

Signs and Symptoms

ACUTE GASTROENTERITIS

Diarrhea

Vomiting

Fever

Abdominal pain

Signs of dehydration

ACUTE GASTROENTERITIS



ACUTE GASTROENTERITIS

Complications

COMPLICATIONS

Reactive arthritis

Guillain-Barré syndrome

Glomerulonephritis

IgA nephropathy

Erythema nodosum

Hemolytic anemia

Hemolytic uremic syndrome

CAUSATIVE AGENT

Salmonella, Shigella, Yersinia, Campylobacter, Cryptosporidium, Clostridium difficile

Campylobacter

Shigella, Campylobacter, Yersinia

Campylobacter

Yersinia, Campylobacter, Salmonella

Campylobacter, Yersinia

S. dysenteriae 1, E. coli

ACUTE GASTROENTERITIS

Laboratory Findings

ACUTE GASTROENTERITIS

Macroscopic examination of stool

Microscopic examination of stool

Stool culture and PCR

Antigen detection tests

ACUTE GASTROENTERITIS

Complete blood count

Serum electrolytes (Na and K)

Kidney function tests (Urea and Cre)

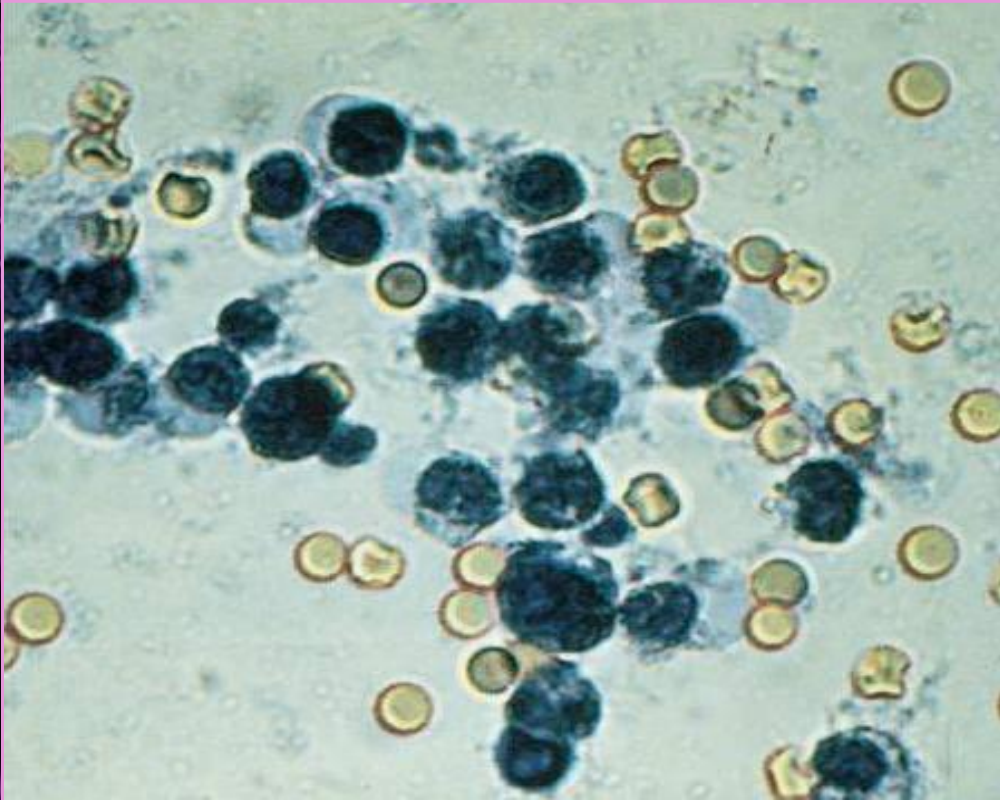
Serum glucose level

Aterial blood gases

ACUTE GASTROENTERITIS

Laboratory Findings

STOOL MICROSCOPY



STOOL MICROSCOPY



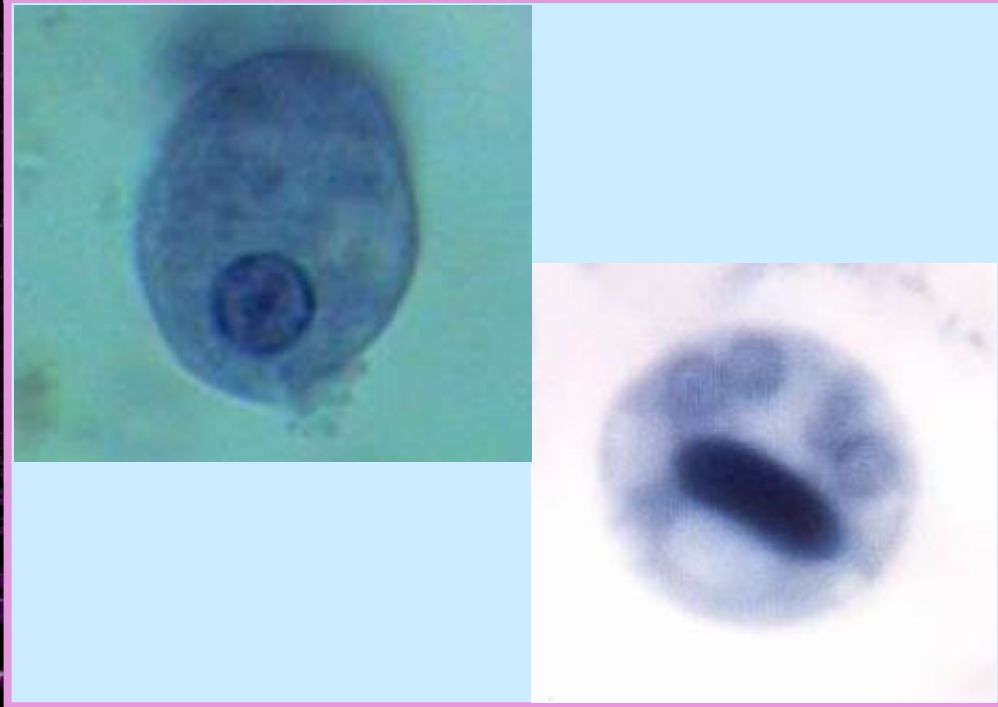
ACUTE GASTROENTERITIS

Laboratory Findings

ENTAMOEBIA HISTOLYTICA



ENTAMOEBIA HISTOLYTICA



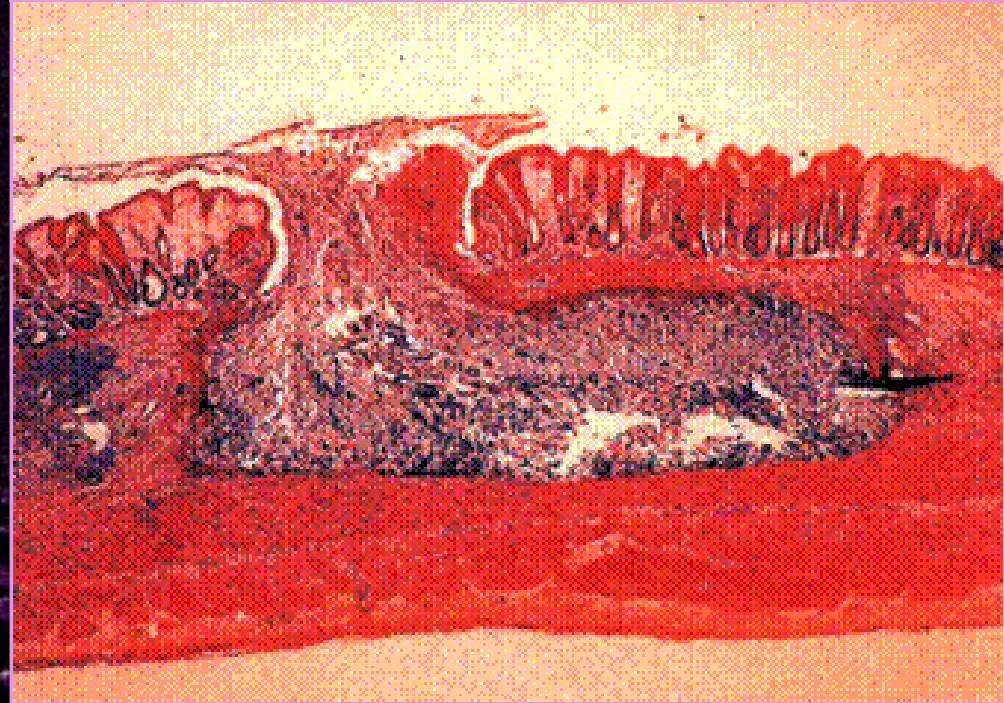
ACUTE GASTROENTERITIS

Laboratory Findings

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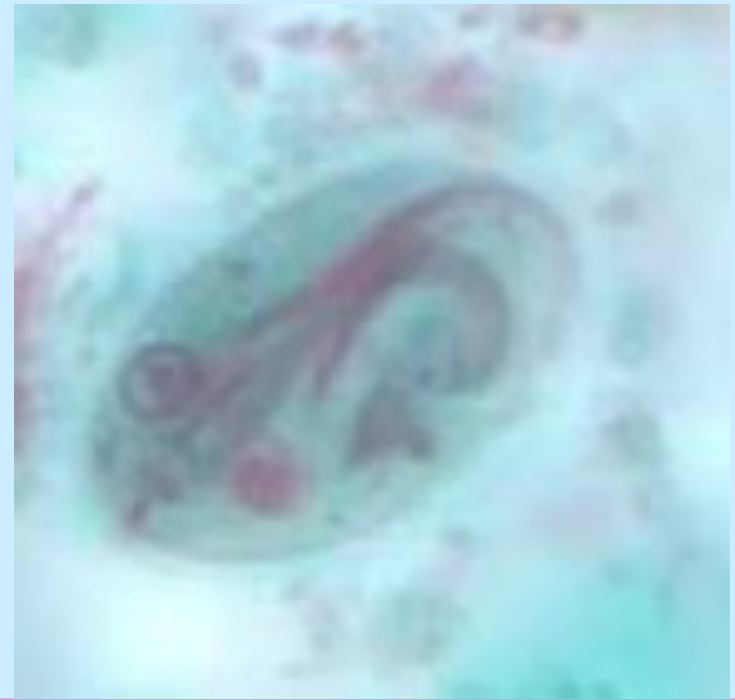
ACUTE GASTROENTERITIS

Laboratory Findings

GIARDIA INTESTINALIS



GIARDIA INTESTINALIS



ACUTE GASTROENTERITIS

Differential Diagnosis

ANATOMICAL DEFECTS

Malrotation
Intestinal duplication
Hirschsprung's disease
Fecal impaction
Short bowel syndrome
Microvilli atrophy
Strictures

MALABSORPTION

Disaccharidase deficiency
Glucose-galactose malabsorption
Pancreatic insufficiency
Cystic fibrosis
Shwachman syndrome
Intraluminal bile salt deficiency
Cholestasis
Hartnup's disease
Abetalipoproteinemia
Celiac disease

ENDOCRINE DISEASES

Thyrotoxicosis
Addison's disease
Adrenogenital syndrome

FOOD POISONING

Heavy metal
Scombroid
Ciguatera
Mushroom

NEOPLASIS

Neuroblastoma
Ganglioneuroma
Pheochromocytoma
Carcinoid
Zollinger-Ellison syndrome
VIP syndrome

OTHERS

Non-GI infections
Milk allergy
Crohn's Disease
Ulcerative colitis
Familial dysautonomia
Immunodeficiency
Protein-losing enteropathy
Acrodermatitis enteropathica
Laxative use
Motility disorders
Pellagra

ACUTE GASTROENTERITIS

Treatment

1

Fluid and electrolyte therapy

2

Maintaining nutrition

3

Symptomatic and supportive treatments

4

Agent-specific treatment with antimicrobial drugs

ACUTE GASTROENTERITIS

Treatment

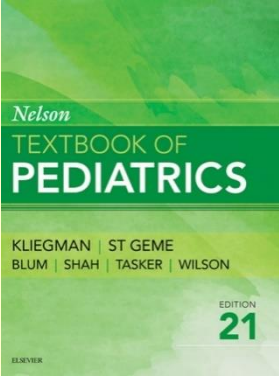
1 **Fluid and electrolyte therapy**

2 **Maintaining nutrition**

3 **Symptomatic and supportive treatments**

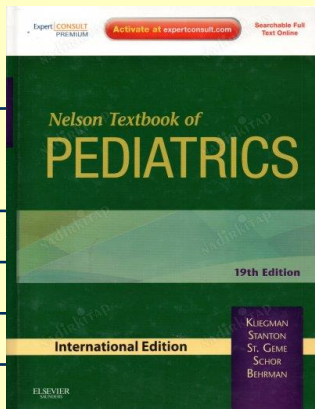
4 **Agent-specific treatment with antimicrobial drugs**

DEHYDRATION CLASSIFICATION (IV)

MILD DEHYDRATION	MILD DEHYDRATION	SEVERE DEHYDRATION
WEIGHT LOSS Infant: <5% Older child and adult: <3%	5-10% 3-6%	> 10% > 6%
CLINICAL FINDINGS Normal physical findings Normal or increased pulse Decreased urine output Thirsty 	Tachycardia Little or no urine output Irritable/lethargic Sunken eyes and fontanel Decreased tears Dry mucous membranes Mild delay in elasticity (skin turgor) Delayed capillary refill (>1.5 sec) Cool and pale	Peripheral pulses either rapid and weak or absent Decreased blood pressure No urine output Very sunken eyes and fontanel No tears Parched mucous membranes Delayed elasticity (poor skin turgor) Very delayed capillary refill (>3 sec) Cold and mottled limp Depressed consciousness

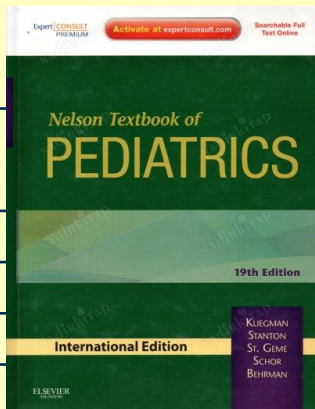
DEHYDRATION CLASSIFICATION (ORAL)

	MINIMAL OR NO DEHYDRATION	MILD TO MODERATE DEHYDRATION	SEVERE DEHYDRATION
Loss of Body Weight	(<%3)	(%3-9)	(>%9)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, or impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skinfold	Instant recoil	Recoil in <2 sec	Recoil in >2 sec
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	More decreased



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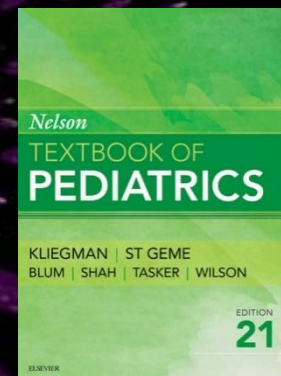
MINIMAL OR NO DEHYDRATION

Rehydration is not required

Suggest continuing gastroenteritis-appropriate nutrition, no less than he/she normally takes.

Encourage increased fluid intake

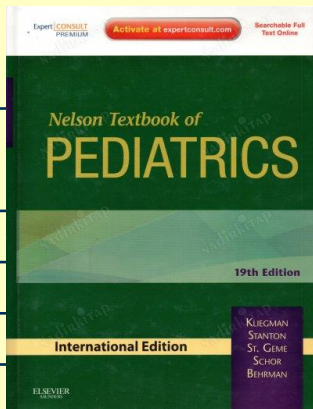
**Sustained ORS is given to replace losses;
After each diarrhea or vomiting:
<10 Kg 60-120 mL ORS
>10 Kg 120-240 mL ORS**

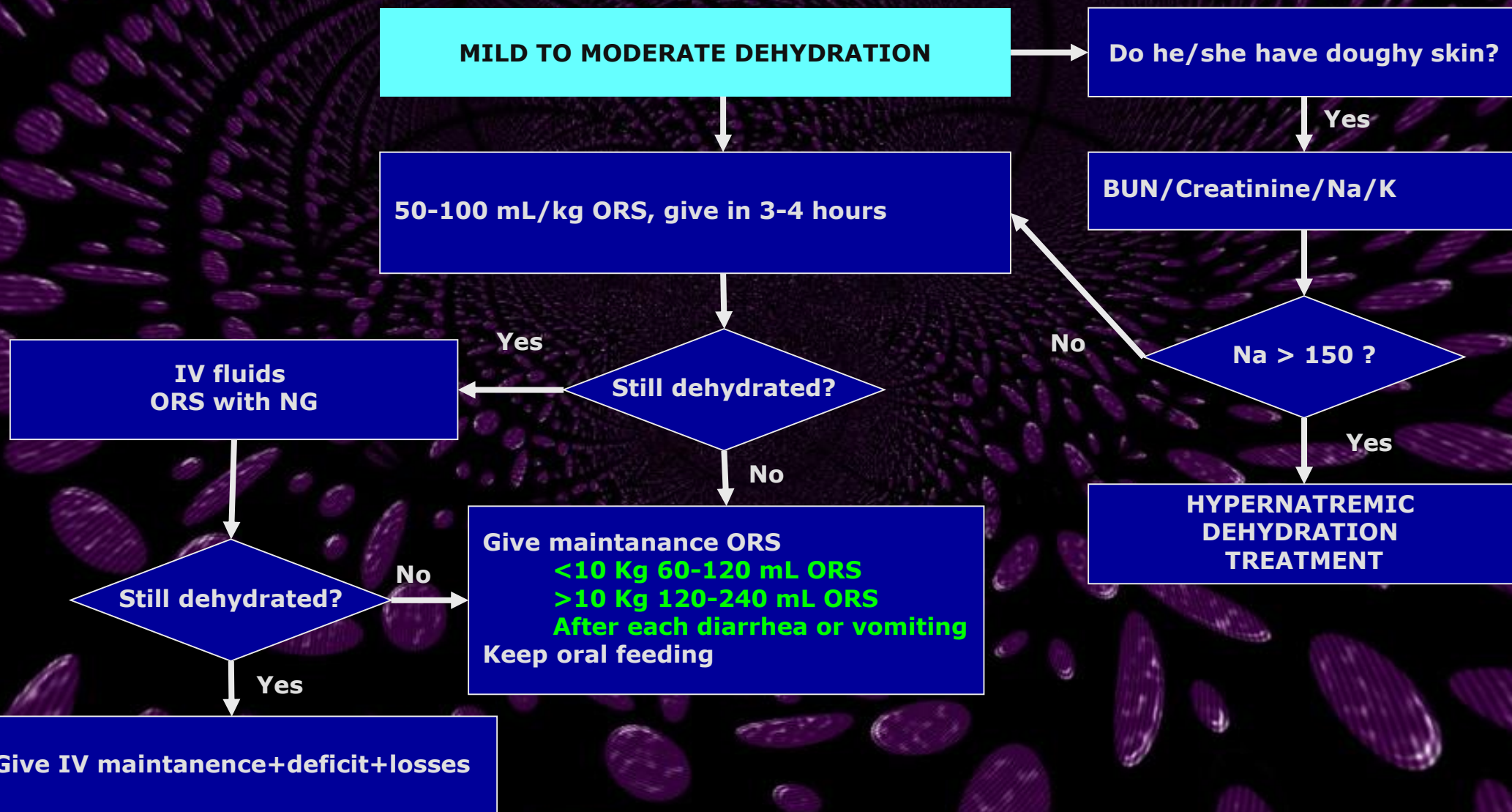


**<10 Kg 50-100 mL ORS
>10 Kg 100-200 mL ORS**

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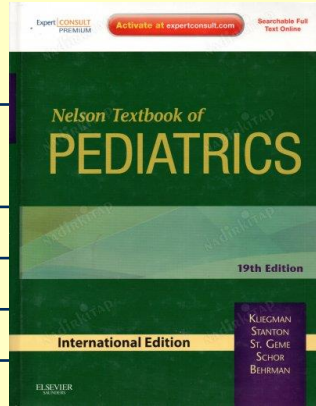
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**SEVERE
DEHYDRATION**

BUN/Creatinin/Na/K

**Complete blood count
ESR/CRP
Arterial blood gases
Blood, urine and stool culture
Blood glucose level**

20 mL/kg SF IV bolus

**Has circulation
improved?**

No

**Repeat bolus up to 3 times
If circulation is not improving**

Yes

**Hypernatremic rehydration
therapy**

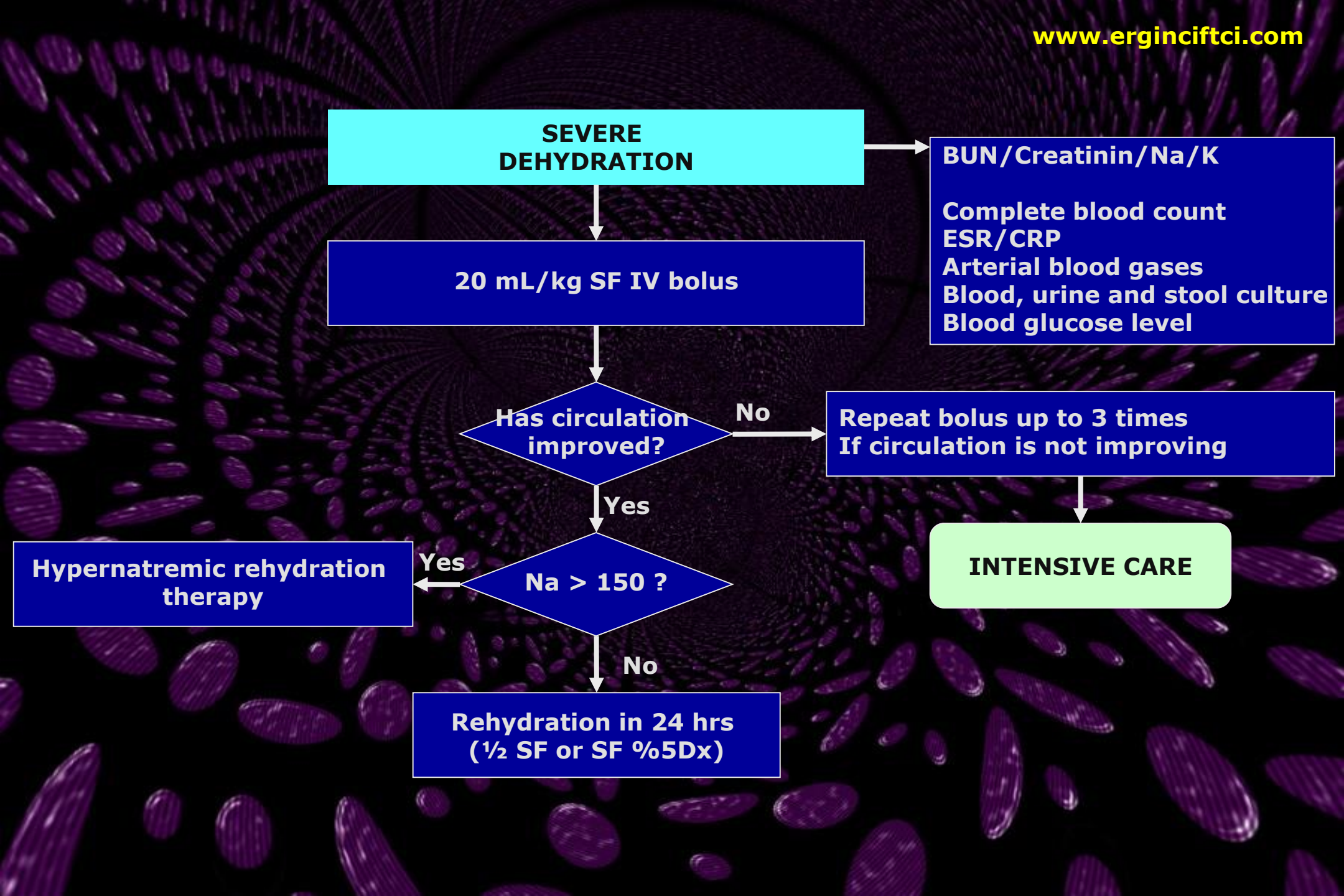
Yes

Na > 150 ?

No

**Rehydration in 24 hrs
($\frac{1}{2}$ SF or SF %5Dx)**

INTENSIVE CARE



ACUTE GASTROENTERITIS

Treatment

1

Fluid and electrolyte therapy

2

Maintaining nutrition

3

Symptomatic and supportive treatments

4

Agent-specific treatment with antimicrobial drugs

ACUTE GASTROENTERITIS

Treatment: Nutrition

Breastfed babies	During rehydration and maintenance continue breastfeeding.
Formula feeding	Resume normal formula after rehydration.
Non-Breastfed Non-Formula feeding	After the rehydration, give the liquid and solid foods that the child normally takes. Avoid foods rich in fatty and simple sugars.

ACUTE GASTROENTERITIS

Treatment: Nutrition

APPROPRIATE

Water
Rice
Potatoes
Soups (potato, carrot, rice)
Yogurt
Ayran
Fruits and vegetables
Bread
Cracker
Milk
Lean meat (Chicken)

INAPPROPRIATE

Cola and similar drinks
Soft drinks
Beverages

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Treatment: Anti-diarrheal Drugs

- ❑ **Drugs that shorten the severity and duration of diarrhea**
 - Anti-motility drugs:** Loperamide, Diphenoxylate+atropine
 - Anti-secretory drugs:** Bismuth subsalicylate, Racecadotril
 - Adsorbent drugs:** Kaolin-pectin, Attapulgit, Smectite
 - ❑ **Shigellosis**
 - ❑ ***C. difficile* colitis**
 - ❑ **Shiga toxin producing *E. coli***
 - ❑ **Drug side effects**
 - ❑ **Drug interaction**
 - ❑ **Cost**
- Prolongation of disease duration**
 - Development of toxic megacolon**
 - HUS development**
 - Development of encephalopathy**
 - Impairment of the absorption of other drugs**

These drugs are not recommended in children.

ACUTE GASTROENTERITIS

Treatment: Anti-emetic Drugs

❑ **Drugs that prevent or reduce vomiting**

Serotonin receptor antagonists

Ondansetron

Phenothiazines

Promethazine, metoclopramide, prochlorperazine

Antihistamines

Dimenhydrinate

Dopamine receptor antagonists

Domperidone

Glucocorticoids

Dexamethasone

These drugs are not routinely recommended in children.

ACUTE GASTROENTERITIS

Treatment: Probiotics and Prebiotics

- ❑ **Probiotics: Live microorganisms that have the potential to benefit the host by altering the host's intestinal flora.**

Saccharomyces boulardii

Lactobacillus rhamnosus GG

Lactobacillus acidophilus

Streptococcus thermophilus

- ❑ **Prebiotics are substrates used selectively by beneficial host microorganisms.**

Fructooligosaccharides

Inulin

- ❑ **The mechanism of action is controversial**

Binding sites from intestinal epithelial cells, competition for nutrients

Secretion of bacteriocins

Stimulation of the immune system...

- | | |
|---------------------------------------|---|
| ❑ Viral gastroenteritis | Shortens the duration of illness |
| ❑ Antibiotics related diarrhea | Generally useful |
| ❑ Tourist diarrhea | Conflicting results have been reported |
| ❑ Dysenteriae | No benefits |

These agents are not routinely recommended in children.

ACUTE GASTROENTERITIS

Treatment: Zinc

Zinc deficiency is associated with T cell dysfunction, and lymphoid atrophy.

Zinc deficiency; Intestinal disaccharidase activity is reduced

Zinc deficiency; Intestinal secretory activity increases

Zinc deficiency; Longer and more severe diarrhea

Zinc deficiency; Higher chance of chronic diarrhea

With its treatment, the duration of diarrhea is reduced by 25%, and the number of defecations by 33%.

In malnourished children and in regions where zinc deficiency is common, 20 mg/day (10-14 days) should be given.

Not routinely recommended in children whose zinc deficiency is not considered.

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ACUTE GASTROENTERITIS

Treatment: Antibiotics

Empirical antibiotic therapy is not usually required.

Administration of antibiotics in EHEC gastroenteritis may increase the risk of HUS.

Infants with severe malnutrition and diarrhea should be given antibiotics.

Toxic patients with suspected bacteremia should be given antibiotics.

Empirical antibiotic therapy should be started according to regional resistance patterns.

ACUTE GASTROENTERITIS

Treatments: Antibiotics

ORGANISM	DRUGS OF CHOICE	DOSAGE AND DURATION OF TREATMENT
<i>Shigella</i>	Ciprofloxacin, Ampicillin, Ceftriaxone, or TMP-SMX	Ceftriaxone IV, IM 50–100 mg/kg/day qd, bid × 7 day
	Most species have become resistant to antibiotics	Ciprofloxacin PO 20–30 mg/kg/day bid × 7–10 day
		TMP 10 mg/kg/day and SMX 50 mg/kg/day bid × 5 day
		Ampicillin PO, IV 50–100 mg/kg/day qid × 7 day
EPEC, ETEC, EIEC	TMP-SMX or Ciprofloxacin	10 mg/kg/day TMP ve 50 mg/kg/day SMX bid × 5 day
		Ciprofloxacin PO 20–30 mg/kg/day qid for 5–10 day
<i>Salmonella</i>	Infections in the normal host with non-typhoidal species do not require treatment	See <i>Shigella</i> therapy
	Indication for treatment: infants <3 months, malignancy, chronic GI disease, severe colitis, hemoglobinopathies, HIV infection and other immunodeficiencies	
	Most species have become resistant to antibiotics	
<i>Aeromonas/Plesiomonas</i>	TMP-SMX	10 mg/kg/day TMP ve 50 mg/kg/day SMX bid 5 day
	Ciprofloxacin	Ciprofloxacin PO 20–30 mg/kg/day bid 7–10 day
<i>Yersinia</i> spp.	Antibiotics are not usually needed for diarrhea	
	Deferoxamine therapy should be discontinued during severe infection or bacteremia. In sepsis, doxycycline, aminoglycoside, TMP-SMX, or fluoroquinolone are used in combination.	
<i>Campylobacter jejuni</i>	Erythromycin or Azithromycin	Erythromycin PO, 50 mg/kg/day tid 5 day
		Azithromycin PO, 5–10 mg/kg/day qid 5 day
<i>Clostridium difficile</i>	Metronidazole (first choice)	PO 30 mg/kg/day tid 5 day
	Vancomycin (second choice)	PO 40 mg/kg/day qid 7 day

ACUTE GASTROENTERITIS

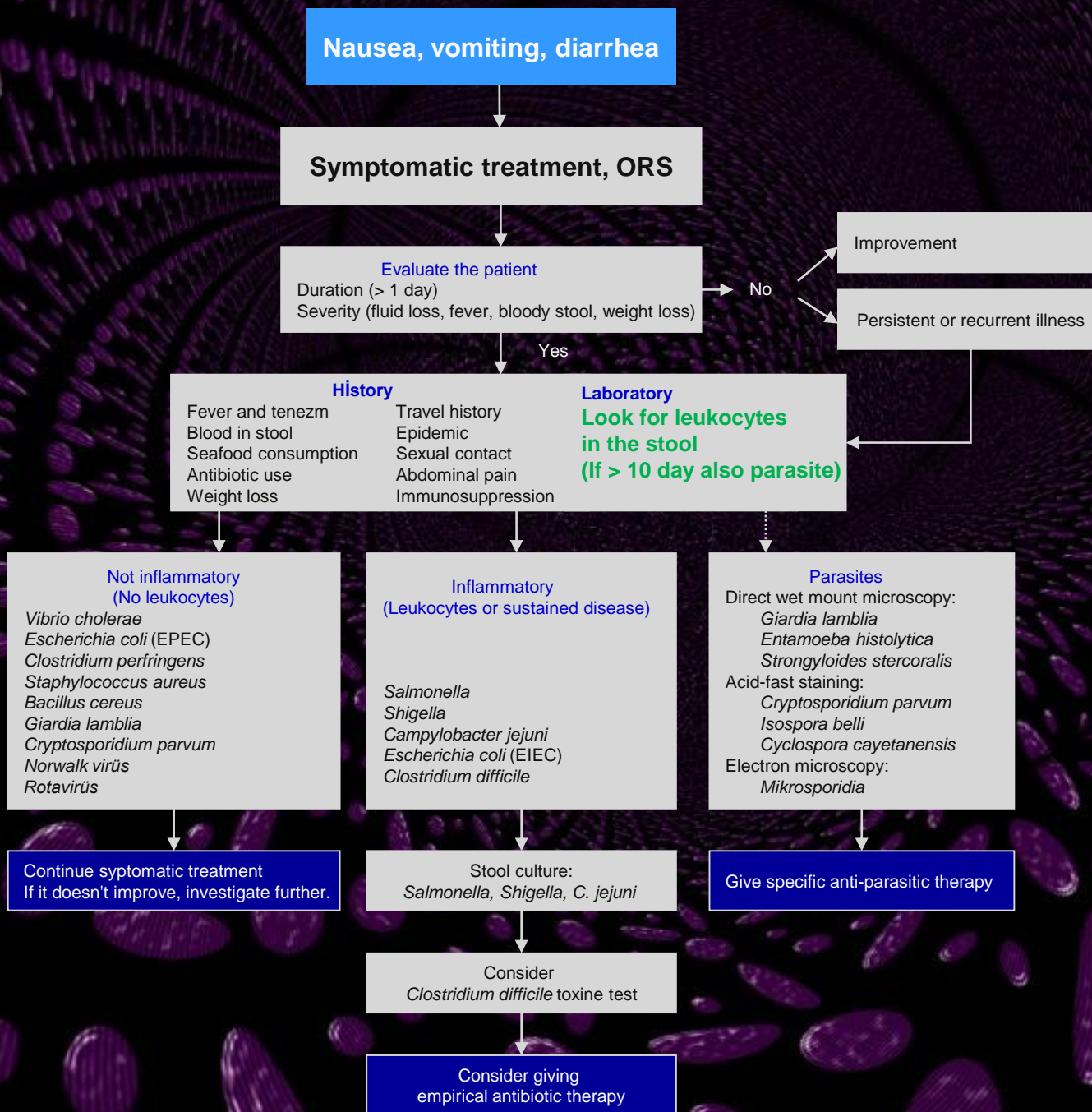
Risk Factors for Salmonella Bacteremia

- ☐ **Newborns**
- ☐ **Infants <3 months**
- ☐ **Infants <12 months with temperatures >39°C**
- ☐ **Immunodeficiency**
- ☐ **Malignancy; especially leukemia and lymphoma**
- ☐ **Immunosuppressive and corticosteroid therapy**
- ☐ **Hemolytic anemia; sickle cell anemia, malaria, bartonellosis**
- ☐ **Collagen vascular disease**
- ☐ **Inflammatory bowel disease**
- ☐ **Gastrectomy or gastroenterostomy**
- ☐ **Achlorhydria or antacid drug therapy**
- ☐ **Bowel motility disorder**
- ☐ **Shistosomiasis**
- ☐ **Malnutrition**

ACUTE GASTROENTERITIS

Treatment: Antiparasitic Drugs

PARASITE	ANTIMICROBIAL DRUG
<i>Balantidium coli</i>	<i>Tetracycline, metronidazole or iodoquinol</i>
<i>Blastocystis hominis</i>	<i>Metronidazole or iodoquinol</i>
<i>Cryptosporidium parvum</i>	<i>Paramomycin or azithromycin</i>
<i>Cyclospora cayetanensis</i>	<i>TMP-SMZ</i>
<i>Encaphalitozoon intestinalis</i>	<i>Albendazole</i>
<i>Entamoeba histolytica</i>	<i>Metronidazole and/or iodoquinol</i>
<i>Enterocytozoon bieneusi</i>	<i>Albendazole</i>
<i>Giardia lamblia</i>	<i>Metronidazole, albendazole, furazolidone or paramomycin</i>
<i>Isospora belli</i>	<i>TMP-SMZ</i>
<i>Strongyloides stercoralis</i>	<i>Ivermectin or thiabendazole</i>
<i>Trichuris trichiura</i>	<i>Mebendazole or albendazole</i>



ACUTE GASTROENTERITIS

Prevention

PREVENTION

Compliance with hygiene rules



PREVENTION



ACUTE GASTROENTERITIS

Prevention

PREVENTION

Breastfeeding



PREVENTION



ACUTE GASTROENTERITIS

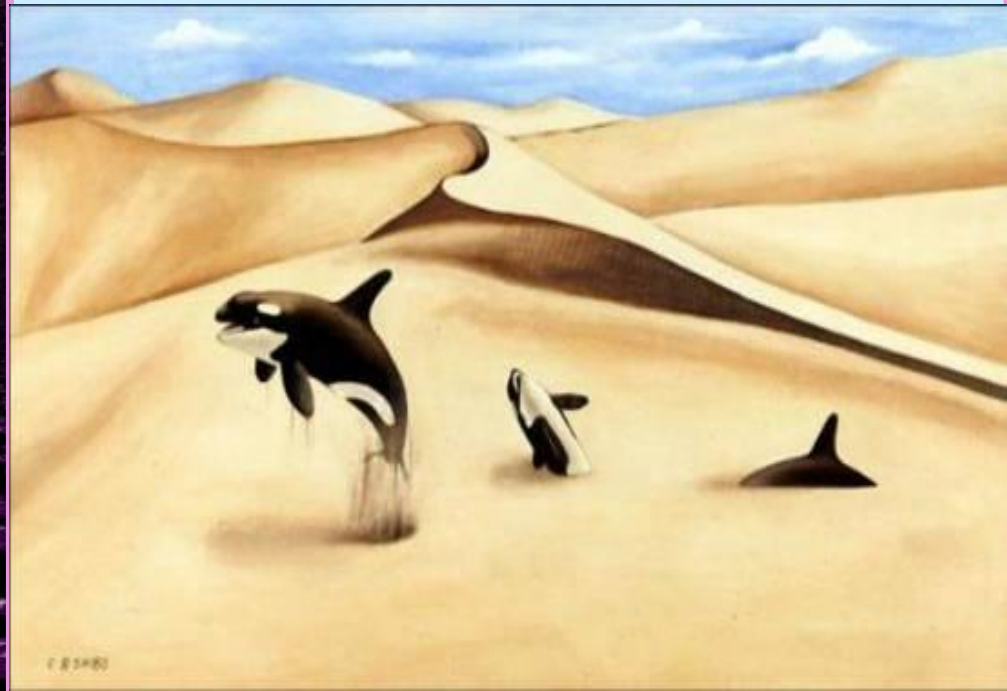
Prevention

PREVENTION

Using clean water and food



PREVENTION



ACUTE GASTROENTERITIS

Prevention

PREVENTION

Vaccination



PREVENTION



