ACUTE GASTROENTERITIS

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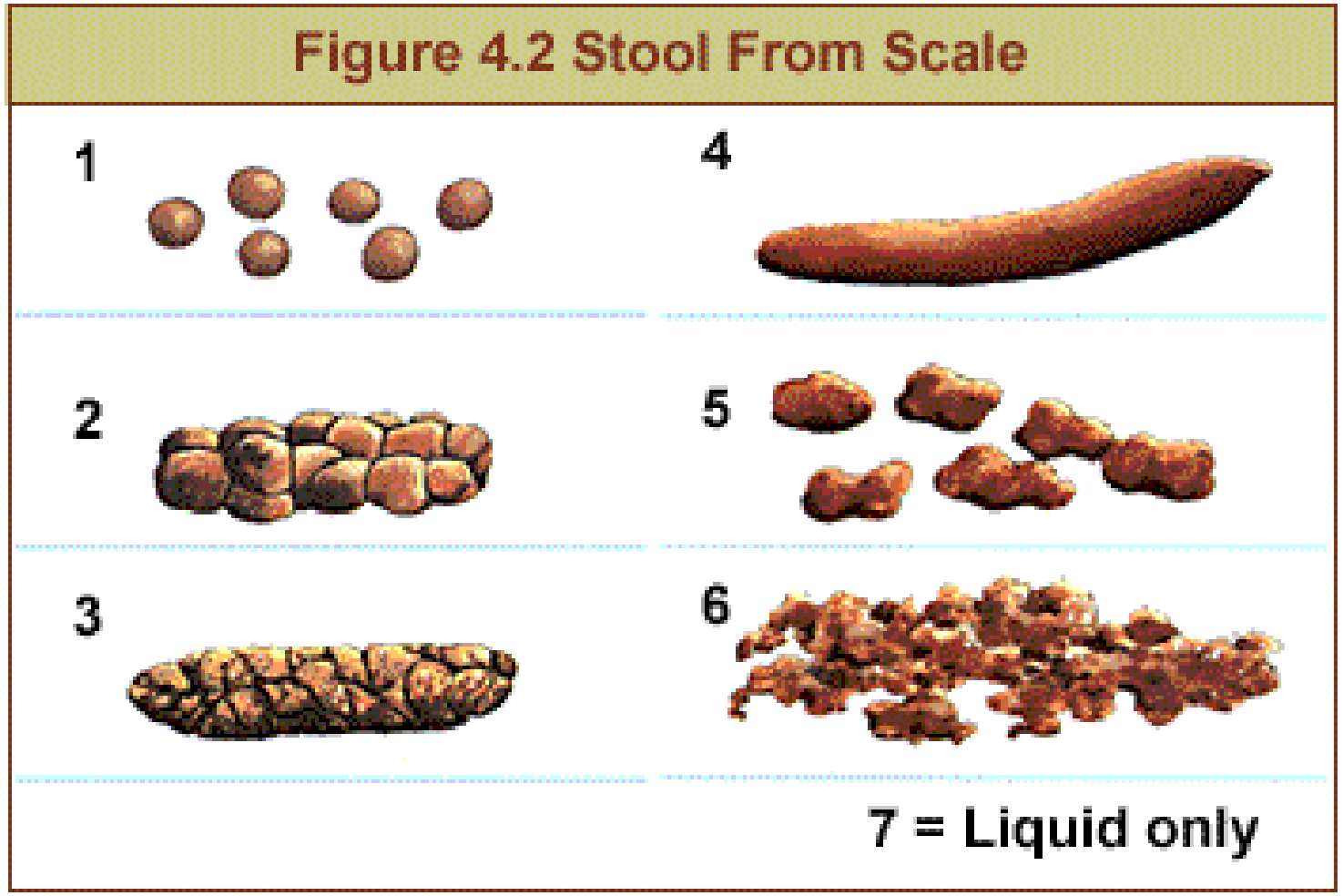
Acute gastroenteritis

Acute gastroenteritis : diarrheal disease of rapid onset with or without accompanying symptoms such as vomiting,fever or abdominal pain

- Diarrhea :- **i**ncrease in stool frequency,fluidity (water content) or volume , in comparison with the previously established "normal" pattern .

- Acute diarrhea less than 2 weeks
- **Dysentry**: blood or mucous in stool

Bristol stool chart



Epidemiology

- **Second most common cause of death in pediatric age group .**
- **1.34 million deaths annually, or roughly 15% of all child deaths, with more than 98% of these deaths occurring in the developing world .**
- **1.7 billion case annually in <5 years**
- **Leading to 124 million clinic visits, 9 million hospitalizations (10% of admissions)**
- **4 episode/child – year**

- **Rota virus is the most common cause worldwide .**

Risk factors

- **AGE is associated with poverty and poor hygiene**
- **Contamination of water and food supply (cholera)**
- **Young age .**
- **Malnutrition :- Zinc and Vitamin A deficiency**
- **Immunodeficiency**

Transmission :- fecal-oral or direct contact

DIARRHEA CLASSIFICATION

- **ACCORDING TO PATHOGEN**
- **ACCORDING TO DURATION**
- **ACCORDING TO MECHANISM OF DIARRHEA**
- **ACCORDING TO CLINICAL TYPE OF DIRRHEA (WATRY / BLOODY)**

Mechanisms of Diarrhea

- **Osmotic (diet-induced)**
- **Secretory (electrolyte transport related)**
- **Exudative**
- **Motility disorders**

Stool osmotic gap = 290-2(K+Na)

Mechanisms of Diarrhea

Osmotic (diet or substrate – induced)

Pathophysiology:

- Digestive ***enzyme*** deficiencies
- Ingestion of ***unabsorbable*** solute

Ex.:-

Viral infection / IBD

Lactase deficiency

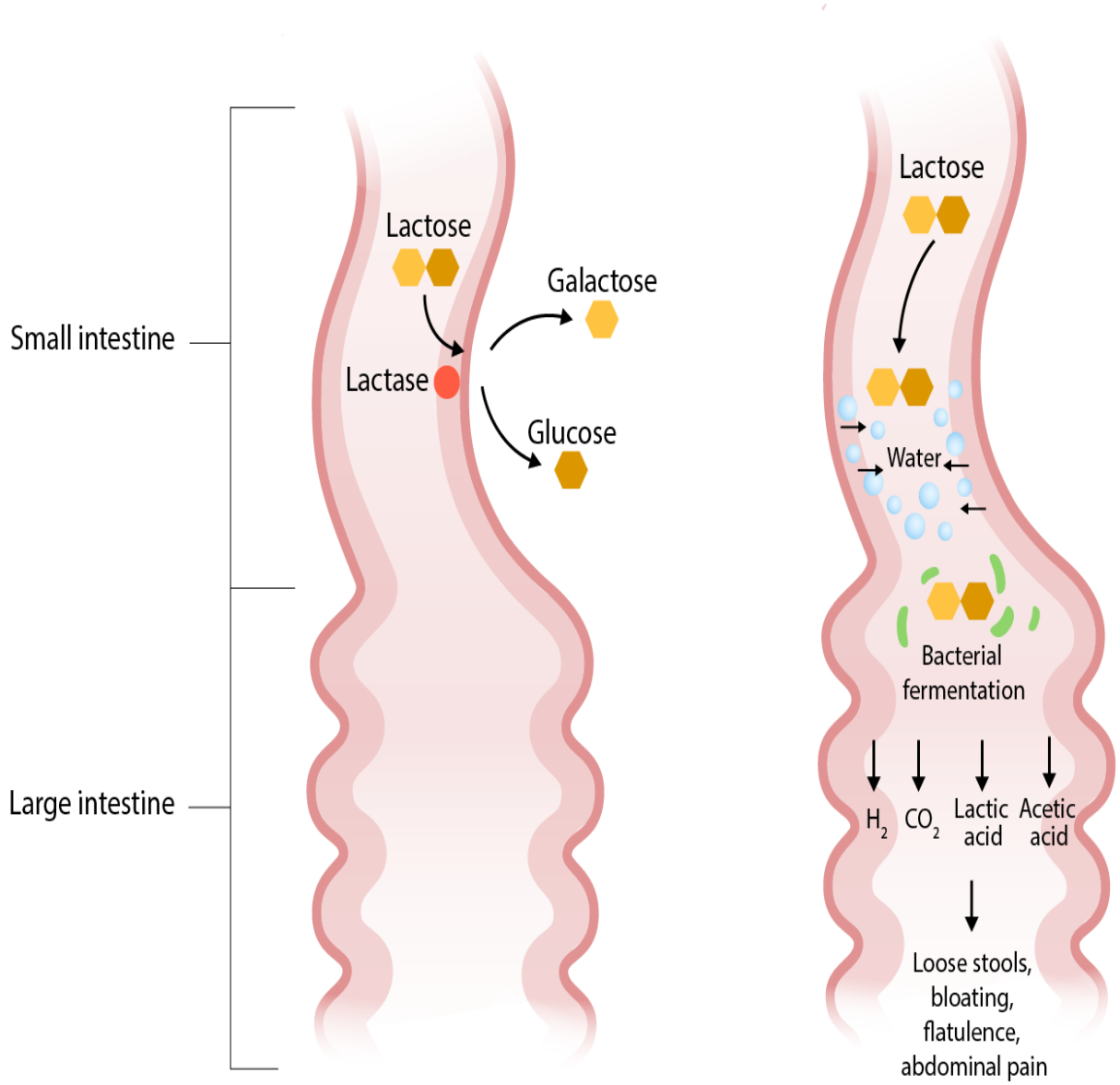
Sorbitol /$MgSO_4$

Features :

Stop with fasting

No stool WBCs

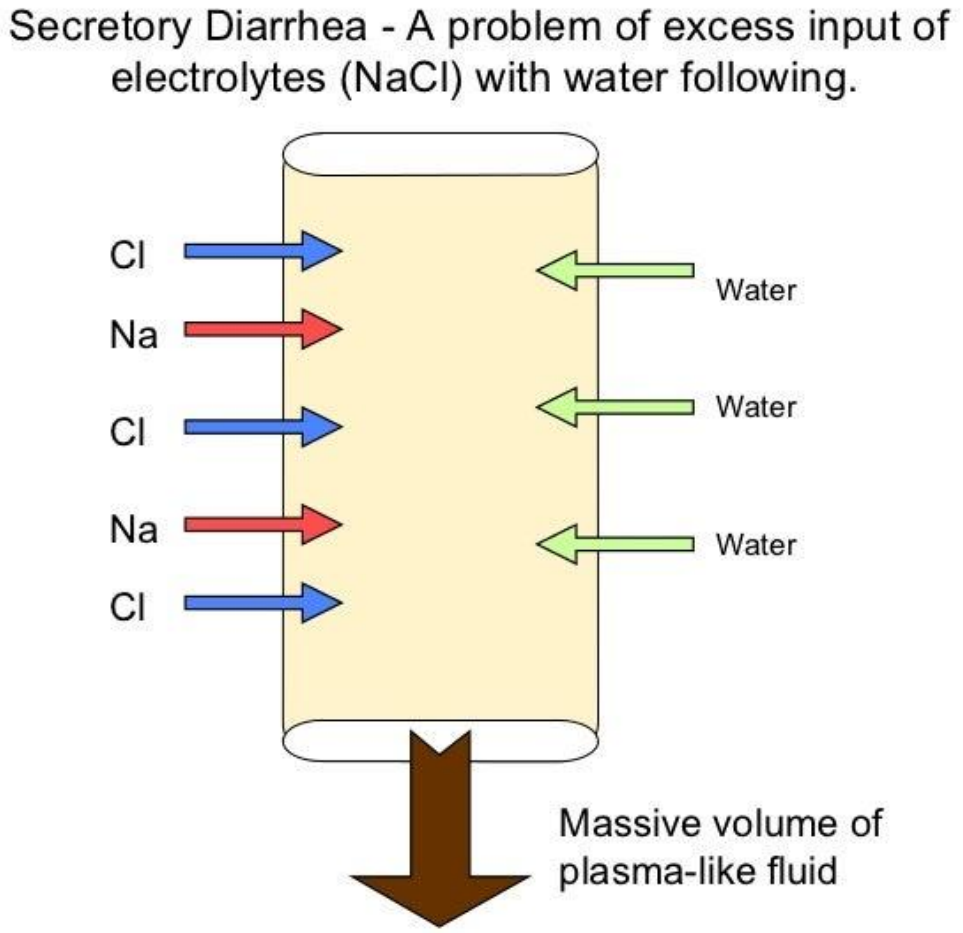
Stool PH low, positive for reducing substances

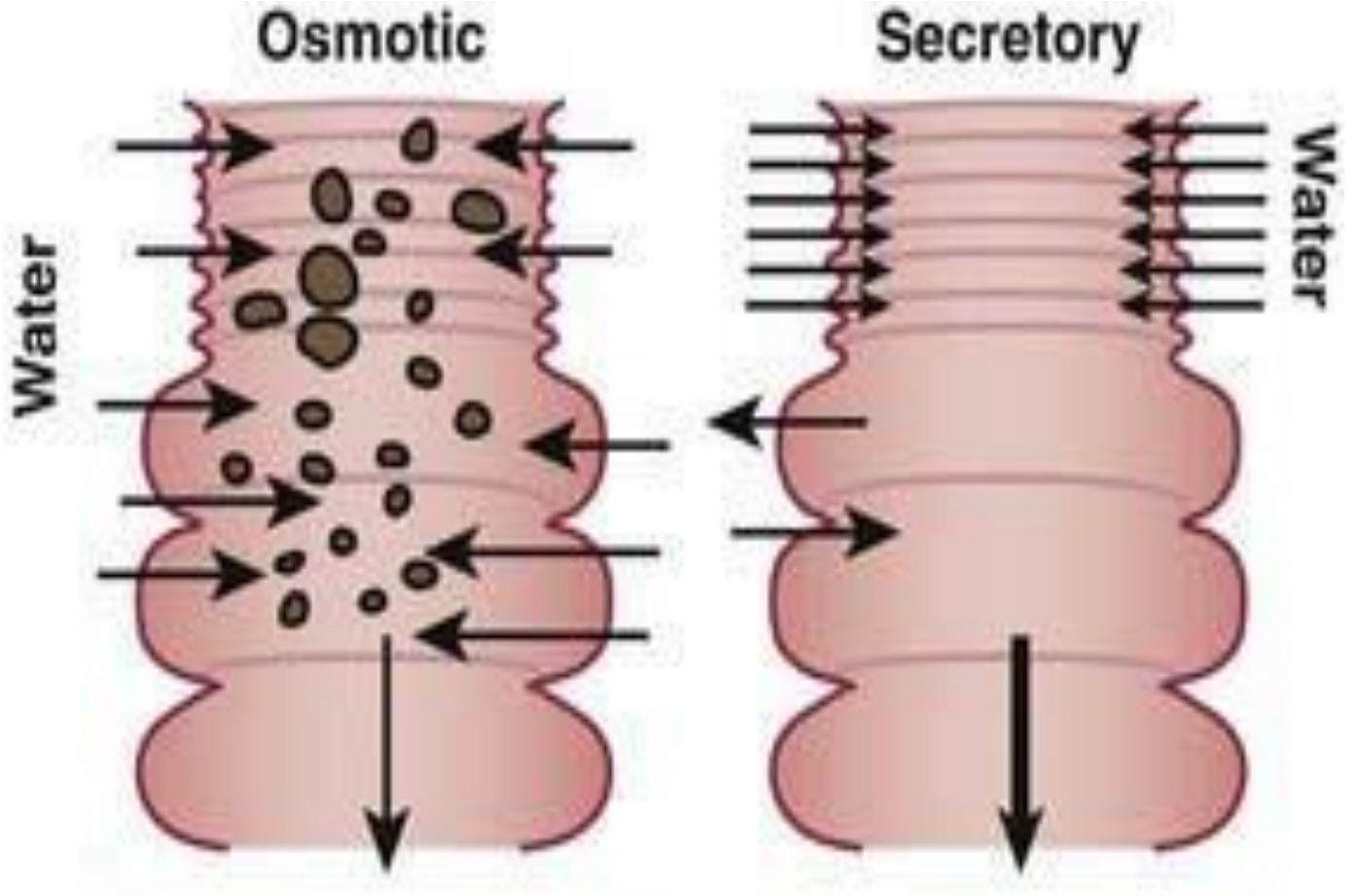

Small intestine
Large intestine
Lactose
Galactose
Lactase
Glucose
Lactose
Water
Bacterial fermentation
H_2
CO_2
Lactic acid
Acetic acid
Loose stools, bloating, flatulence, abdominal pain

Secretory diarrhea (electrolyte transport related)

- **Stimulation of active *chloride* secretion from the crypt cells into the lumen**

- **Mediated by preformed bacterial toxins, as cholera toxin, E.coli, Shigella, Salmonella, and Campylobacter jejuni**





	Osmotic	Secretory
Stool volume:	Moderately increased	Very large
Response to fasting:	Diarrhea stops	Diarrhea continues
Stool osmolality:	Normal to increased	Normal
Ion gap:	≥ 100 mOsm/kg	< 100 mOsm/kg

Mechanisms of Diarrhea

Exudative Diarrhea: (inflammation – related) :

Pathophysiology:

Inflammation

Decreased colonic reabsorption

Increased motility

Ex.:

Bacterial enteritis (shigella), Parasitic (Amebic)

Features:

Blood, mucus and WBCs in stool

Mechanisms of Diarrhea

Reduction in anatomic surface area of absorption

Short bowel syndrome

celiac disease

partial villous atrophy secondary to postgastroenteritis malabsorption syndrome, tropical sprue, microvillous inclusion disease

Causes

- Viral
- Bacterial
- Parasitic

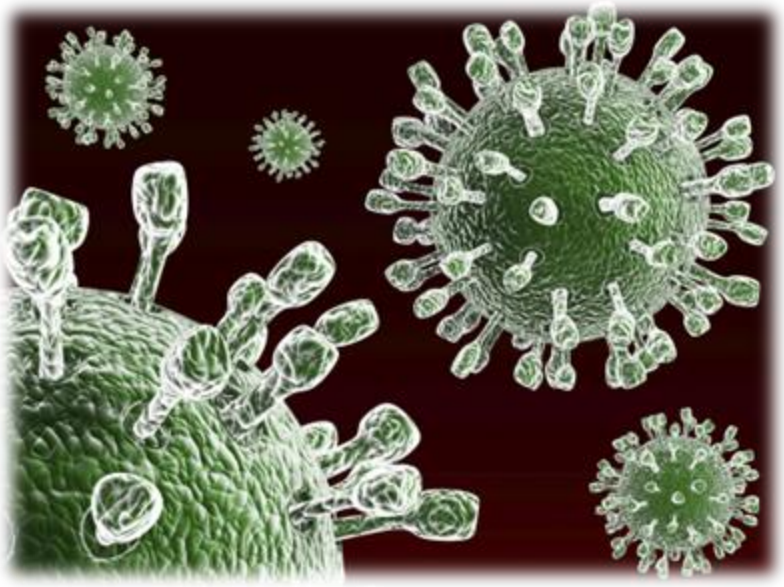
Viral

Accounts for 70 – 80% of cases of GE

- Rota
- Norovirus
- Other viral agents (astroviruses, adenoviruses, parvoviruses)

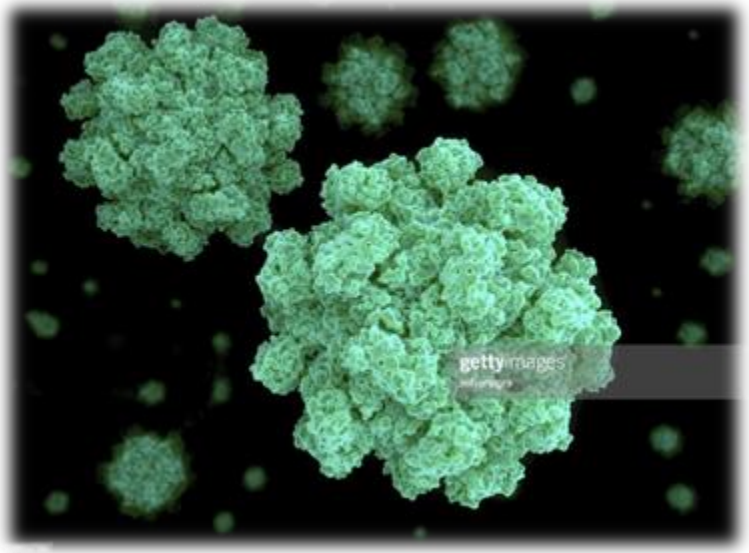
Rota

- Double stranded RNA virus, 11 segemts, Reoviridae family
- Most common cause worldwide, responsible for 37% of diarrhea-related deaths in children younger than 5 years.
- G1, G2, G3, G4 s are responsible for 90% of isolates.
- IP: 2-4 d, duration: 4-8 days
- Vomitting followed with watery diarrhea,low grade fever
- Dx :- Stool immunoassay
- Tx :- Supportive
- Prevention :- Rota vaccine



Calicivirus (Norvoviruses and Sapoviruses)

- **RNA virus**
- **Including norovirses and sapoviruses**
- **The leading cause of gastroenteritis in USA**
- **Ip 1- 2 d , duration 1 -3 days .**
- **Vomiting is more prominent in children, diarrhea in adult**
- **Dx: Routine RT-PCR and EM on fresh unpreserved stool samples**
- **Tx: supportive**



Bacterial

Accounts for 10-20% of cases of GE

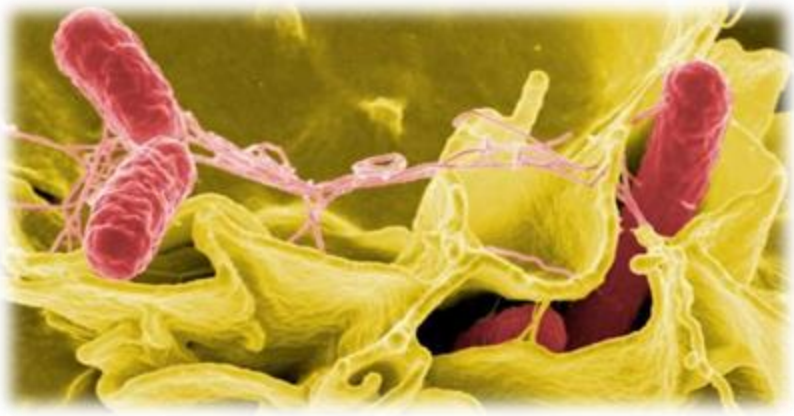
- **Campylobacter jejuni**
- **Salmonella**
- **Shigella**
- **E.coli**
- **Others: Bacillus cerus,staph aureus, clostridium perferngis, Listeria, cholera, yersenia**

Campylobacter jejuni

- IP 1 - 5 days
- Reservoir: Domestic animals and poultry
- Transmission: feco-oral or direct contact with infected animal or their products
- From mild watery diarrhea to bloody diarrhea, abdominal cramps, fever,
- Severe with immunodeficiency bacteremia .
- May mimic appendicitis
- Duration: 5 – 7 days some times > 10 d s, self limiting .
- Dx: routine stool culture
- Tx: supportive, in severe cases erythromycin or azithromycin
- Complications: GBS, Reactive artheritis

Salmonella enterica (Non-typhoidal)

- **Transmission is by ingestion of contaminated animal food products (eggs, chicken)**
- **IP 1-5 days, Duration: 3-7 days**
- **Symptoms range from self-limited watery diarrhea to less commonly bloody diarrhea**
- **Antibiotic is not indicated**
- **Antibiotic used if :**
- **- Age<3 months ,immune deficiency, ill looking, sickle cell anemia (osteomyelitis)**
- **Ceftriaxone, Ampicillin, gentamycin, TMP-SMS,**



Shigella

- IP 1-5 days, duration 4-7 days
- Invades colon, causing inflammatory response
- Shiga toxin responsible for extra intestinal manifestation
- Bloody diarrhea (initially watery), fever, abdominal cramps
- Dx: Stool culture
- Antibiotics: ceftriaxone, Ampicillin, TMP-SMZ.
- Complications: seizures , HUS, Rectal prolapse, sepsis

E.Coli

- **EHEC (enterohemorrhagic e.coli)**

✓**Including O157H7, (STEC)**

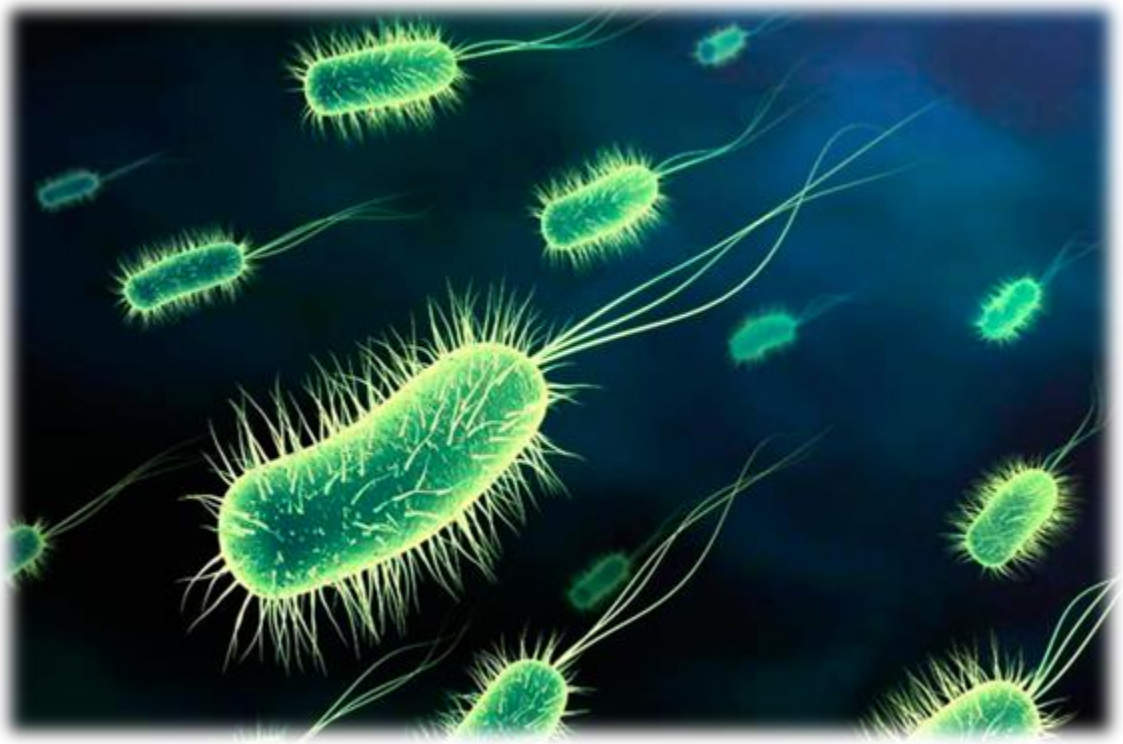
✓**IP 1-9 days, Duration 4- 7 days**

✓**Bloody diarrhea**

✓**Dx: stool culture**

✓**Tx: supportive**

✓**Complications: HUS**



E.Coli

- **ETEC (Traveler diarrhea) (enterotoxigenic ecoli)**

✓**IP 1-3 days, Duration 3-7 days**

✓**Watery diarrhea**

✓**Dx: stool culture**

✓**Tx: supportive, if needed TMP-SMX**

Classification of *Escherichia coli* associated with diarrhea

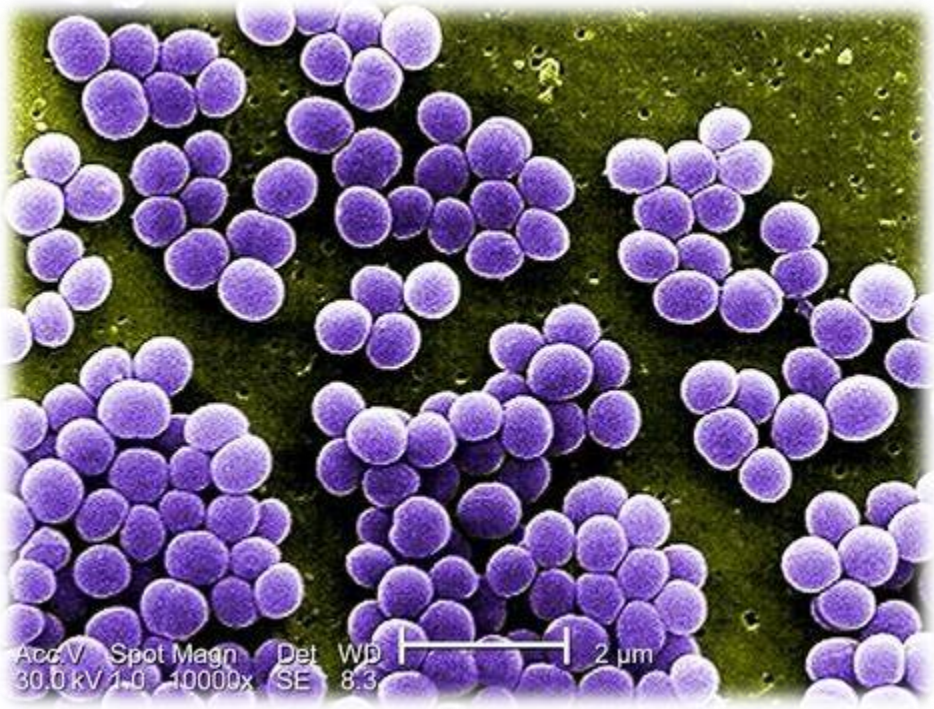
E coli type	Epidemiology	Type of diarrhea
Enterohemorrahgic	Hemorrhagic colitis and hemolytic uremic syndrome in all ages and postdiarrheal thrombotic thrombocytopenic purpura in adults	Bloody or nonbloody
Enteropathogenic	Acute and chronic endemic and epidemic diarrhea in infants	Watery
Enterotoxigenic	Infantile diarrhea in developing countries and traveler's diarrhea in all ages	Watery
Enteroinvasive	Diarrhea with fever in all ages	Bloody or nonbloody; dysentery
Enteroaggregative	Acute and chronic diarrhea in infants	Watery, occasionally bloody

Vibrio Cholera

- IP 1-5 days
- Watery diarrhea "rice water stools " abdominal cramps, fever
- Duration: 3-7 days
- Dx: stool culture special media
- Tx: oral and IVF, azithromycin , Doxacycline, tetracycline and TMP-SMZ
- Complications: Severe life threatening dehydration

Staphlococcus aureus

- **ip : 1 – 6 hr**
- **Suden onset of sever nausea and vomiting , abdominal cramp , diarrhea and fever**
- **Duration 1- 3 days .**
- **Tx : supportive**



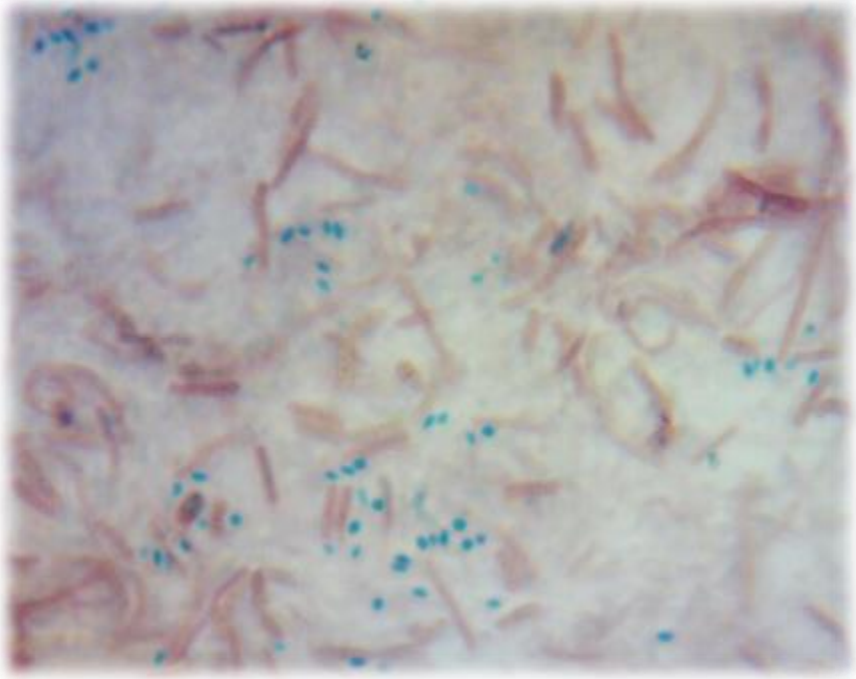
Bacillus cerus

- IP 1-6 hrs

causing severe nausea, vomiting, and diarrhea.

- Contaminated food (fried rice, meats)

- Most emetic patients recover within 6 to 24 hours
- but in some cases, the toxin can be fatal via fulminant hepatic failure.



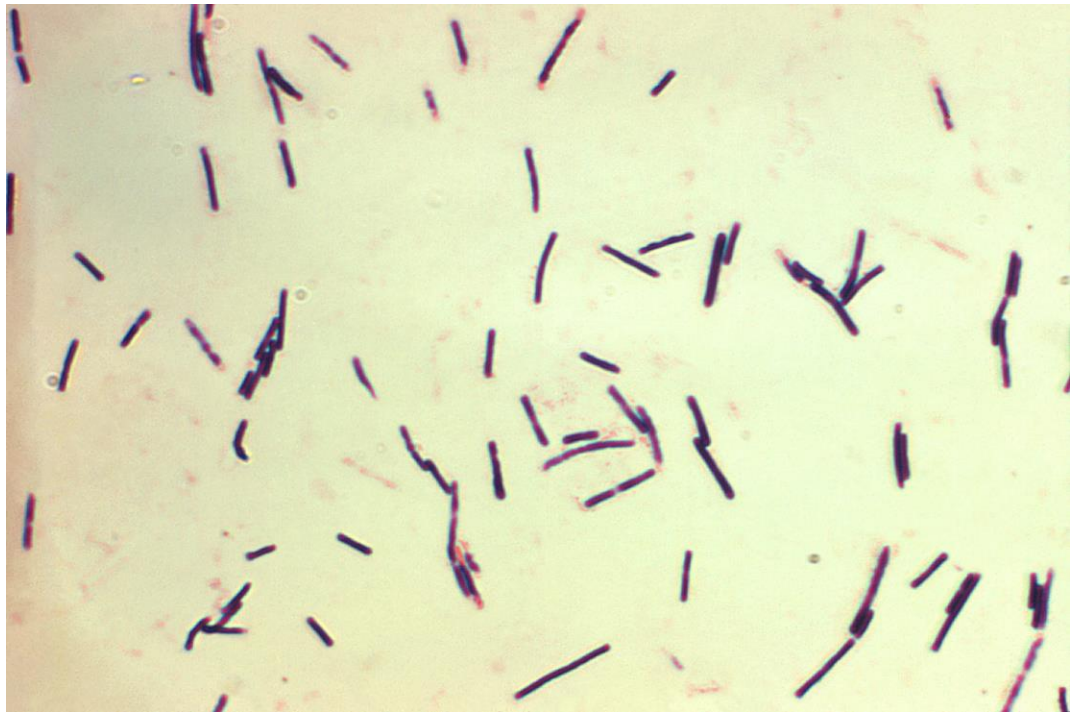
Clostridium perfringens

Clostridium perfringens is one of the most common causes of food poisoning in the United States .

poorly prepared meat and poultry, or food properly prepared .

Dx : stool cx .

Tx : more often susceptible to vancomycin



Yersinia enterocolitica

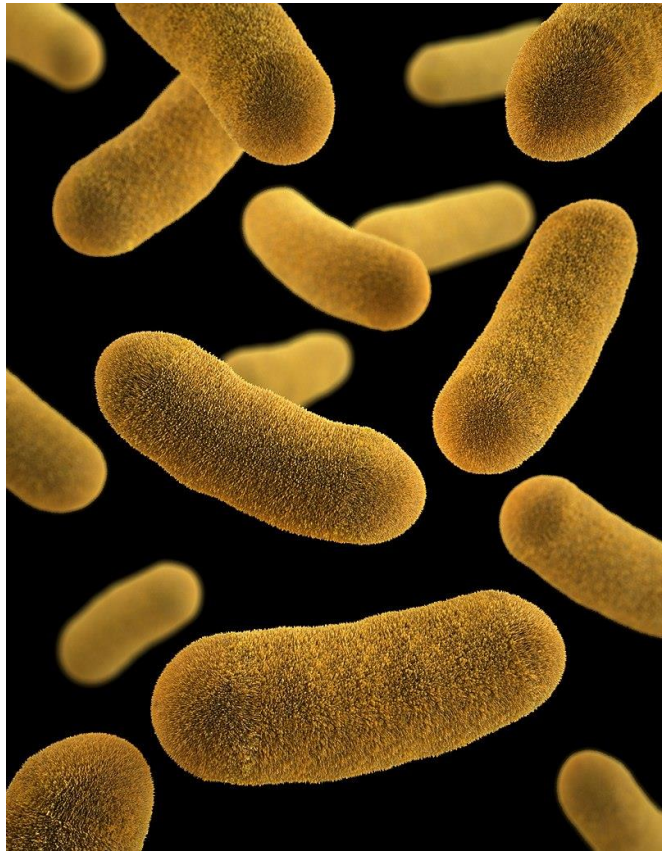
The organism is acquired usually by insufficiently cooked pork or contaminated water, meat, or milk .

self-limiting and does not require treatment

if associated with immunosuppression, the recommended regimen includes doxycycline in combination with an aminoglycoside. Other antibiotics active against *Y. enterocolitica* include trimethoprim-sulfamethoxasole, fluoroquinolones, ceftriaxone, and chloramphenicol.

***Y.enterocolitica* infections are sometimes followed by chronic inflammatory diseases such as arthritis, erythema nodosum, and reactive arthritis. This is most likely because of some immune-mediated mechanism.**

- Mimic appendicitis .

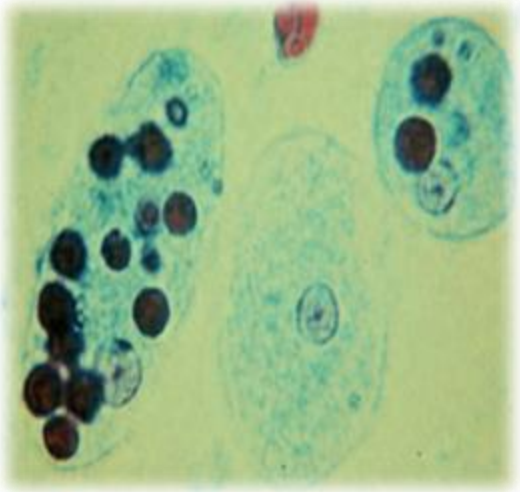


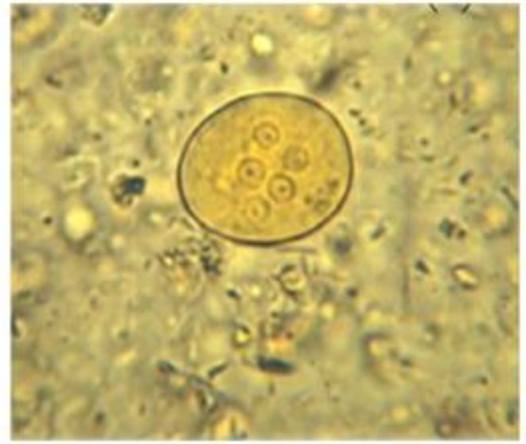
Parasitic

- **Entamoeba histolytica**
- **Cryptosporidium**
- **Giardia lamblia**

Entamoeba histolytica

- IP: 2 -4 wk
- Diarrhea (often bloody and mucus), lower abdominal pain
- Examination of stool for cysts and trophozoite; may need at least 3 samples + fecal leukocytes
- E.histolytica stool antigen
- Complication: Liver and Lung abscesses
- Tx: Metronidazole and a luminal agent (iodoquinol or diloxanide , Paromomycin)





Cryptosporidium

- **IP: 1-11 days**
- **Watery diarrhea**
- **Severe in immunodeficiency**
- **Supportive care, If severe consider nitazoxanide for 3 days**

History

- **Diarrhea: Duration, frequency, volume, blood, mucus,**
- **Vomiting: Duration, content, presence of blood, bile stained, projectile,**
- **Abdominal pain**
- **Urination: either increased or decreased (wet diaper), concentrated, color, dysuria**
- **Fever**
- **Rash, rhinorrhea, cough, conjunctivitis, sore throat**
- **Activity, feeding**
- **Antibiotic use**
- **Contact, travel history**
- **Seizure**
- **Degree of dehydration**

Physical exam

- **General: ill appearance, level of alertness, lethargy, irritability.**
- **Growth parameters**
- **HEENT**
- **Chest exam**
- **Abdominal exam: tenderness, guarding, organomegaly**
- **Back: costophrenic angle tenderness**
- **Skin: rash, jaundice, a doughy feel to the skin may indicate hypernatremia**

Skin turgor is assessed by pinching the skin of the abdomen or thigh between the thumb and the bent forefinger in a longitudinal manner. The sign is unreliable in obese or severely malnourished children.

Symptom or Sign	Mild Dehydration	Moderate Dehydration	Severe Dehydration
Wt loss	**3-5%**	**6-10 %**	**9 – 15 %**
Mental status	Alert	Restless, irritable	Lethargic, unconscious
Thirst	Drinks normally	Drinks eagerly	Drinks poorly
Heart rate	Normal	Normal to increased	Tachycardia
Quality of pulses	Normal	Normal to decreased	Weak or unpalpable
Breathing	Normal	Normal or fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil <2 seconds	Recoil >2 seconds
Capillary refill	Normal	Prolonged	Prolonged or minimal
Extremities	Warm	Cold	Cold, mottled, cyanotic
Urine output	Normal	Decreased	Minimal

Lab testing

- **Indicated for children with moderate/ severe dehydration, patients treated wit IVF, or patients with history and physical exam are inconsistent with GE .**

Lab testing

- ✓**Basic electrolytes**
- ✓**glucose**
- ✓**KFT**
- ✓**ABG**
- ✓**CBC, Blood culture**
- ✓**Urine analysis and culture**

Routine stool exam

- **Look for blood, mucus**
- **Fecal leukocytes: bacterial invasion of colonic mucosa**
- **Cyst and trophozoites: G. lamblia and E. histolytica**

Stool culture

- **Bloody diarrhea (dysentery)**
- **Stool microscopy indicates fecal leukocytes**
- **Immunocompromised**

Other stool testing

- ✓**Stool immunoassay for Rota and Adenovirus**
- ✓**Stool antigen for Amebiasis and Giardia if suspected**
- ✓***C difficile* toxins: if child older than 2 year with a recent history of antibiotic**

Management

- **ORS is recommend as the treatment of choice for children with mild-to-moderate GE.**
- **In those presenting with severe dehydration, IV access should be obtained and followed by an immediate 20-mL/kg bolus of normal saline.**
- **Antibiotics are generally not indicated, because most cases of GE are viral**

Indications of admission

- **Severe dehydration**
- **Intractable vomiting or diarrhea**
- **Decreased oral intake or hypoactivity**
- **Uncertain diagnosis or if sepsis is suspected**
- **Young age < 6 m**
- **Electrolyte disturbances, or any other complications**
- **Failure of ORS treatment**

ORS

CI:

- **Shock**
- **Ileus, intussusception**
- **Carbohydrate intolerance (rare)**
- **Severe emesis**
- **High stool output (>10 mL/kg/hr)**

ORS

- **Minimal dehydration: 2-10 ml/kg ORS for each diarrhea and vomiting**
- **Moderate dehydration: 50-100 ml/kg over 2-4 hours then continue as above**
- **Severe dehydration: IVF**

Types of ORS

Solution	Carbohydrate (gm/L)	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Base* (mmol/L)	Osmolarity (mOsm/L)
ORS						
World Health Organization (WHO) (2002)	13.5	75	20	65	30	245
WHO (1975)	20	90	20	80	30	311
European Society of Paediatric Gastroenterology, Hepatology and Nutrition	16	60	20	60	30	240
Enfalyte®†	30	50	25	45	34	200
Pedialyte®§	25	45	20	35	30	250
Rehydralyte®¶	25	75	20	65	30	305
CeraLyte®**	40	50–90	20	NA††	30	220
Commonly used beverages (not appropriate for diarrhea treatment)						
Apple juice§§	120	0.4	44	45	N/A	730
Coca-Cola®¶¶ Classic	112	1.6	N/A	N/A	13.4	650

" محلول الاكوالسال ..

سهل الاستعمال ..

بقضي على جفاف
اطفالنا في الحال .. "

Don’t

- **Home remedies including soda, fruit juices, and tea are not suitable for rehydration or maintenance therapy because they have inappropriately high osmolalities and low sodium concentrations.**

- **Don’t use antidiarrheal medication .**
- **- lopremide has been linked to cases with sever abdominal distention and even death**

Others

- **Continue feeding: age-appropriate diet**
- **Probiotic**
- **Zinc supplements**
- **Antiemetics**
- **Antibiotics**

Continue feeding: age-appropriate diet

- **The mother should be encouraged to breastfeed more frequently than usual and for longer at each feed.**

- **If the child is not exclusively breastfed, then oral intake (including clean water, soup, rice water, or yogurt drink) should be emcouraged**

Probiotics

- **They are live microorganisms in fermented foods that potentially benefit the host by promoting a balance in the intestinal flora.**
- **Possible mechanisms of action include synthesis of antimicrobial substances, competition with pathogens for nutrients, modification of toxins.**
- **Lactobacillus rhamnosus GG, Saccharomyces boulardii**
- **probiotics decreased the duration of diarrhea when compared with ORS therapy alone.**

Zinc supplements

- **Recommended in patients known to have zinc deficiency or in areas where zinc deficiency and moderate malnutrition is prevalent.**

- **A little data exist to support this recommendation for children in developed countries**

Antibiotic indication

- **In cases of GE caused by Shigella, E.histolytica, Giardia, Cholera**
- **Antibiotic used in salmonella if: Age<3 months, immune deficiency, ill looking, sickle cell anemia**

- **Oral metronidazole for C. difficile, oral vancomycin for resistant cases**

Antiemetics

- **Ondansetron serotonin antagonist reduced vomiting and the need for intravenous (IV) rehydration and hospital admission**

- **Other medications as metoclopramide is not recommended routinely, due to their possible side effects (extrapyramidal manifestation)**

Prevention

- Vaccination
- Hand hygine
- Breast feeding

Prevention: Rota vaccine

- Oral live attenuated vaccine
- Rotarix (2 doses), RotaTeq (3 doses)
- Both active in preventing severe gastroenteritis, and both have demonstrated reductions in diarrhea-related hospitalizations.

- Contraindications:

1. Hypersensitivity
2. Infants with severe combined immunodeficiency disease (SCID) or immunosuppression
3. Infants aged <6 weeks and >32 weeks
4. History of uncorrected congenital malformation of the GI tract that would predispose infant to intussusception
5. Infants with a history of intussusception

Thank you