

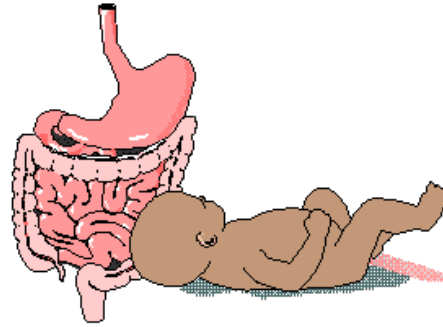
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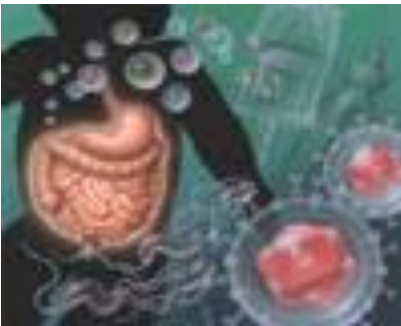
Gastroenteritis in Children



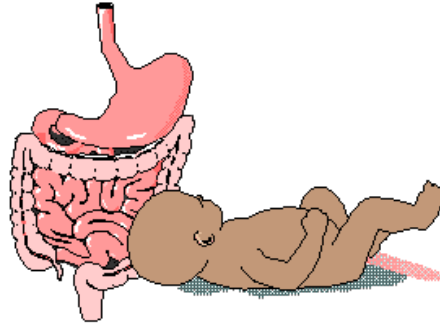
Case 1



- An eleven-month-old male was admitted to Al Ain Hospital after a 4-day history of vomiting and profuse watery diarrhea.



Diarrhea



- **Definition:**

An increase in the fluidity, volume and frequency of stools.

- **Acute diarrhea:**

Short in duration (less than 2 weeks).

- **Chronic diarrhea:**

6 weeks or more

Etiology of Diarrhea(infant)

Acute Diarrhea

Gastroenteritis

Systemic infection

Antibiotic association

Overfeeding

Chronic Diarrhea

Post infections

**Secondary disaccharidase
deficiency**

Irritable colon syndrome

Milk protein intolerance

Types of Diarrhea

➤ Acute watery diarrhea: (80% of cases)

Dehydration

Malnutrition

➤ Dysentery: (10% of cases)

Anorexia/weight loss

Damage to the mucosa

➤ Persistent diarrhea: (10% of cases)

Dehydration

Malnutrition

Mechanisms of Diarrhea

- Osmotic
- Secretory
- Exudative
- Motility disorders

Mechanisms of Diarrhea

➤ Osmotic

Defect present:

Digestive enzyme deficiencies

Ingestion of unabsorbable solute

Examples:

Viral infection

Lactase deficiency

Sorbitol/magnesium sulfate

Infections

Comments:

Stop with fasting

No stool WBCs

Mechanisms of Diarrhea

➤ Secretory:

Defect:

Increased secretion

Decreased absorption

Examples:

Cholera

Toxinogenic E.coli

Comments:

Persists during fasting

No stool leukocytes

Mechanisms of Diarrhea

➤ Exudative Diarrhea:

Defects:

Inflammation

Decreased colonic reabsorption

Increased motility

Examples:

Bacterial enteritis

Comments:

Blood, mucus and WBCs in stool

Mechanisms of Diarrhea

- **Increased motility:**

Defect:

Decreased transit time

Example:

Irritable bowel syndrome

GASTROENTERITIS

- ❑ Acute gastro-intestinal illness usually due to infection
- ❑ Characterised by vomiting and diarrhoea
- ❑ Can occur at all ages, but infants principal group
- ❑ More common in countries with poor hygiene standards, water sanitation problems
- ❑ Sporadic or epidemic forms
- ❑ Often associated with food poisoning

Causes of acute diarrhoea in infancy and childhood

- ❑ **Non-enteric causes:** otitis media. Meningitis, sepsis generally
- ❑ **Non-infectious causes:** milk/food allergies, drug side effects, malabsorption
- ❑ **Infections** of the gastrointestinal tract

Infantile gastroenteritis: principal causes

- ❑ *Escherichia coli*
 - enteropathogenic
 - enterotoxigenic
 - enteroinvasive

- ❑ Viruses
 - rotavirus
 - Noroviruses (Norwalk like)

Enteropathogenic *Esch coli* (EPEC)

- ❑ Small intestine affected
- ❑ Local destruction of intestinal epithelial cells
- ❑ Causes infantile diarrhoea
- ❑ Fever, nausea, vomiting, non-bloody stools
- ❑ Self-limiting
- ❑ Supportive care, no specific antibiotic treatment

EPEC Cont'd

- ❑ More than 20 (O) serotypes have been identified in outbreaks of infantile diarrhoea
- ❑ May affect maternity or neonatal units
- ❑ Adherence and colonizing factors appear important in pathogenesis (no toxin)

Enterotoxigenic *Esch coli*

- ❑ Infant diarrhoea, Travelers' diarrhoea
- ❑ Cause low grade fever, nausea, watery diarrhoea, cramps
- ❑ Small bowel affected
- ❑ Heat labile enterotoxin with cholera like effect
- ❑ Heat stable toxin
- ❑ Fluid and electrolyte loss

Enteroinvasive *Esch coli* (EIEC)

- ❑ Fever, watery diarrhoea, cramps
- ❑ Develops to (bacillary) dysentery, bloody stools
- ❑ Large bowel affected, by invasion and local destruction of epithelial cells
- ❑ Not enteropathogenic serotypes or enterotoxin producers

Viral gastroenteritis

- ❑ Frequent cause of infantile gastroenteritis
- ❑ Up to 50% of cases caused by **rotaviruses** in under 3 year olds
- ❑ Short incubation of 2-4 days
- ❑ Presents as acute diarrhoea of mild to moderate severity, may be vomiting
- ❑ More common in winter months
- ❑ Diagnosed by detection of rotavirus antigen in stool
- ❑ Supportive care

Other viruses causing infantile gastroenteritis

- ❑ Noroviruses ('Norwalk like viruses') and Sapoviruses are 2 genera of the family Caliciviridae
- ❑ (Small round structured viruses (SRSV))
- ❑ Astroviruses
- ❑ Adenoviruses

Infantile gastroenteritis: other infectious causes

- ❑ *Salmonella* spp: usually food poisoning species, can cause outbreaks on units

Note: enteric fever species also can cause this presentation

- ❑ *Shigella* spp: cause bacillary dysentery
- ❑ *Campylobacter jejuni*
- ❑ *Giardia lamblia*

Enterohaemorrhagic *Esch coli*

- ❑ Haemorrhagic colitis with severe abdominal cramps, watery then bloody diarrhoea
- ❑ Cause Haemolytic Uraemic Syndrome (HUS)
- ❑ Often caused by *E coli* 0157
- ❑ Children more affected with renal failure
- ❑ Antibiotics don't alter course

Cryptosporidiosis

- ❑ A self limiting diarrhoeal illness in children
- ❑ Accompanied by nausea and vomiting
- ❑ Acquired by drinking contaminated water containing cysts of *Crypto parvum*
- ❑ Its very resistant to chlorination
- ❑ Source is infected cattle
- ❑ A more severe illness occurs in immunocompromised (AIDS)
- ❑ Diagnosed by finding cysts in stool (acid 'fast')
- ❑ No specific treatment

Giardiasis

- ❑ Caused by *Giardia lamblia*
- ❑ Protozoon pathogen
- ❑ Cosmopolitan
- ❑ Acquired by ingestion of cysts in contaminated food or water (resists chlorination)
- ❑ These develop into trophozoites in duodenum
- ❑ Symptoms of cramping abdo pain, flatulence, diarrhoea

Giardiasis: Diagnosis and management

- ❑ Find cysts or rarely trophozoites in stool
- ❑ Need to perform a stool 'concentration'
- ❑ Look at several samples
- ❑ Occasionally need duodenal aspirate or small bowel biopsy
- ❑ Metronidazole is antimicrobial of choice

Bacillary dysentery (SHIGELLOSIS)

- ❑ *Shigella sonnei* is the most common species in developed countries
- ❑ Causes a mild intestinal illness, with fever, malaise, self-limiting diarrhoea
- ❑ Requires low infecting dose acquired by direct contact
- ❑ Short incubation period
- ❑ Is locally invasive in large bowel
- ❑ Isolate organism on selective culture media

Shigellosis cont'd

- ▶ Other 3 species *S flexneri*, *S boydii*, *S dysenteriae* usually acquired abroad
- ▶ *S dysenteriae* causes severe illness which in developing countries can be fatal
- ▶ Produces an enterotoxin
- ▶ For this form of disease antibiotic therapy necessary: ciprofloxacin (plasmid mediated resistance occurs)

Uncommon causes

- ❑ Amoebic dysentery
- ❑ Causative organism: *Entamoeba histolytica*
- ❑ Mainly found in Indian sub Continent, Africa (but Worldwide distribution)
- ❑ Acquired from eating food contaminated with cysts
- ❑ Causes ulceration of the colon
- ❑ Variation in severity of symptoms but can be severe diarrhoea with blood and mucus in stool

Amoebic dysentery

- ❑ Can progress to cause perforation of large bowel and peritonitis
- ❑ Also, liver involvement with hepatitis or liver abscess
- ❑ Diagnosis made by finding amoebic trophozoites in 'warm' stool
- ❑ Serology positive in liver infection (immunofluorescence test for antibody)
- ❑ Treatment with metronidazole (emetine in non responders)

Cholera

- ▶ A severe diarrhoeal illness with production of 'rice water' stools
- ▶ Vomiting and nausea may accompany
- ▶ Leads to dehydration, prostration, electrolyte loss, circulatory and renal failure
- ▶ Due to toxigenic V cholerae of 3 types, classic, El Tor, and O139

Cholera cont'd

- ▶ Typically water borne
- ▶ Short incubation period
- ▶ *Vibrio* attaches to small intestinal epithelium and produces an enterotoxin which causes increased cyclic AMP production with outpouring of fluid and electrolytes
- ▶ Treat by rehydration and antibiotics (tetracycline or ciprofloxacin)
- ▶ Prevent by good sanitation, heat drinking water, oral vaccine

Other infections of intestinal tract

- ▶ Enteric fever (typhoid and paratyphoid) caused by *Salmonella enterica* serotypes *Typhi/paratyphi*
- ▶ *Yersinia enterocolitica* gastroenteritis
- ▶ *Aeromonas hydrophila* (aquatic organism)
- ▶ *Plesiomonas shigelloides* colitis
- ▶ Pseudomembranous colitis (*C difficile*)

Complications of Diarrhea

- Dehydration
- Metabolic Acidosis
- Gastrointestinal complications
- Nutritional complications

Complications of Diarrhea

Metabolic Acidosis

- Reduced serum bicarbonate
- Reduced arterial PH
- Compensating respiratory alkalosis

Complications of Diarrhea

Gastrointestinal complications

- Secondary carbohydrate malabsorption
- Protein intolerance
- Persistent diarrhea

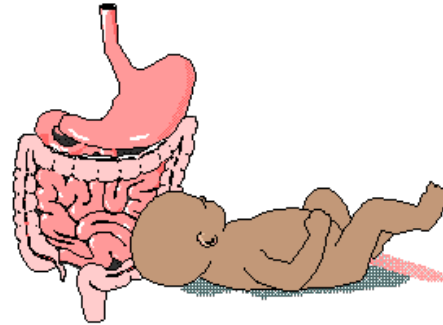
Haemolytic uraemic syndrome

- ❑ May follow 'uncomplicated' diarrhoeal illness
- ❑ Haemolytic anaemia, acute renal failure, thrombocytopenia
- ❑ Caused by verocytotoxin (VTEC) same as *S dysenteriae* type 1 toxin
- ❑ Identified in microbiology lab as sorbitol non fermenting strains

HUS

- ▶ Most outbreaks due to strain O157:H7
- ▶ A large outbreak occurred in Scotland 1996 associated with consumption of meat contaminated by organism
- ▶ Many deaths in elderly people
- ▶ Source was cattle
- ▶ Control by good hygiene practices

Vomiting



➤ **Definition:**

The forceful expulsion of contents of the stomach and often, the proximal small intestine.

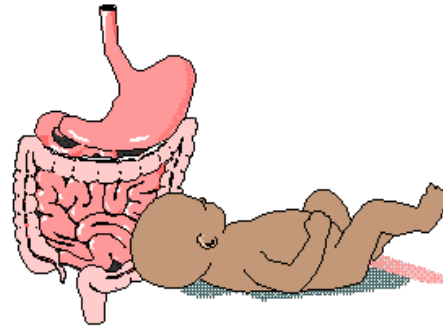
Physiology of Vomiting

- Nausea
- Retching
- Emesis or vomition

Causes of vomiting

Causes	Adults	Infants/Children
Infection (viral "stomach flu")	Common	Common
Food poisoning or infection	Common	Common
Motion sickness	Occasionally	Common
Over-eating/over-feeding	Uncommon	Common
Blocked intestine	Uncommon	Uncommon, but in early infancy must always be considered
Other illnesses, especially those causing high fever	Occasionally	Common
Cough	Uncommon	Common

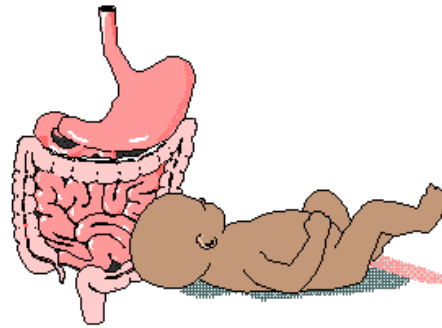
Nausea



➤ **Definition:**

Felling of revulsion for food and an imminent desire to vomit.

Retching



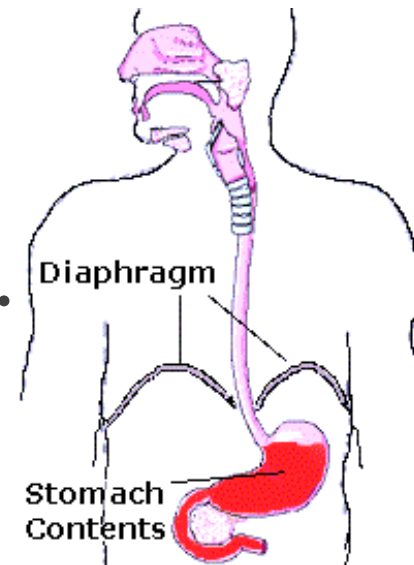
➤ **Definition:**

Spasmodic respiratory movements
with a closed glottis.

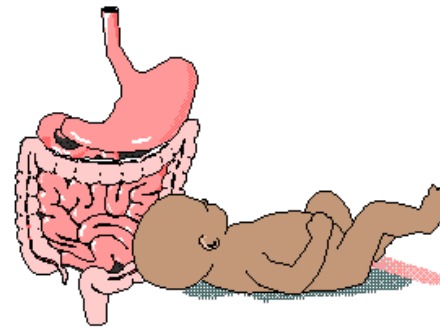
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Emesis or Vomition

- Deep inspiration, the glottis is closed and the is raised to open the USE.
- The diaphragm contracts to increase negative intrathoracic pressure.
- Abdominal muscles contract.

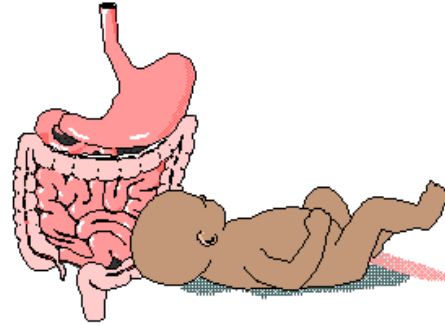


History



- This child was fully breast fed and has been healthy until this current illness.
- He was taken to a private clinic in the town 2 days prior to this admission.
- Medication were prescribed to stop vomiting and diarrhea.
- The clinicians advised the mother to stop breast feeding and to use oral electrolyte solution (ORS) and apple juice to drink.

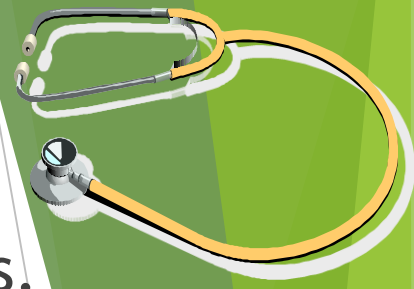
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- The child could not tolerate the medication and continue to have more frequent watery stool and occasionally mixed with mucus.
- Mother noticed that her child has fever and had no urination during past 24 hours.

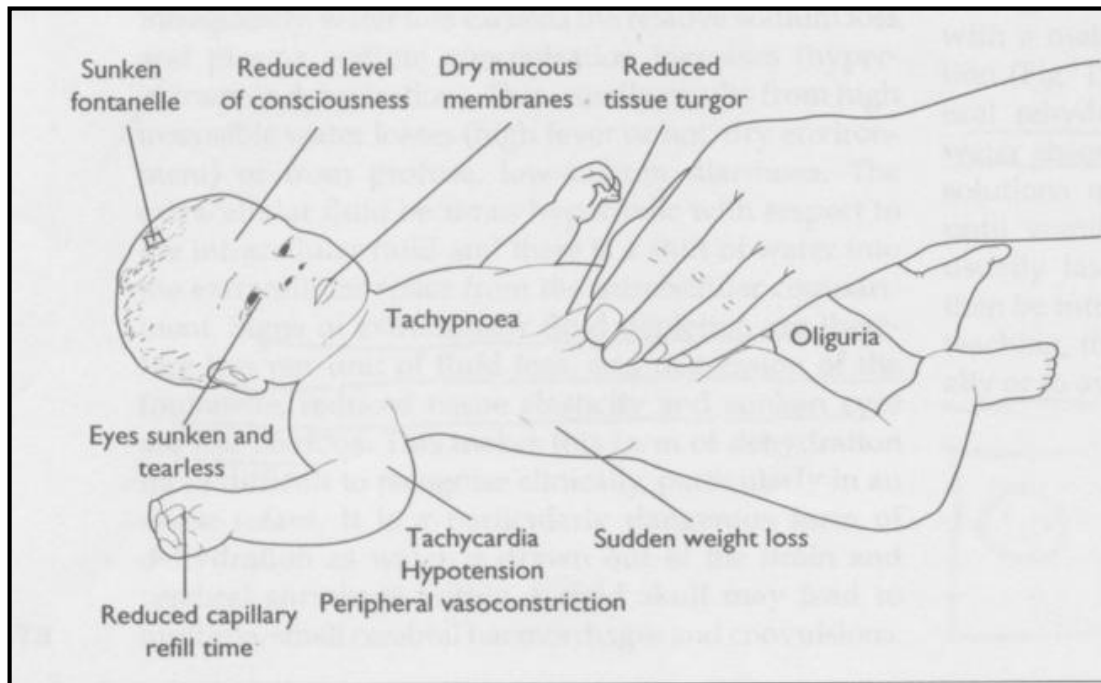
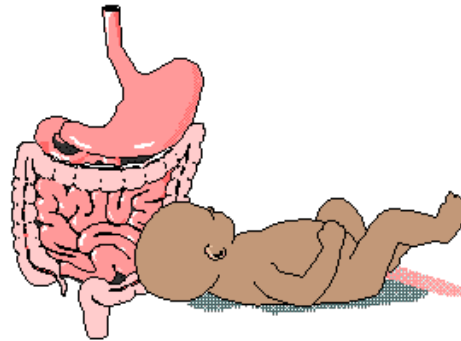


Physical Examination



- Lethargic febrile infant with cool extremities.
- Anterior fontonellae markedly depressed and eyes were sunken.
- Blood pressure 45/30 mm Hg, difficult to obtain.
- The pulse 160 beats/min, with weak pulsation.
- Temperature 39° C, skin turgor markedly decreased.
- The tongue and buccal mucosa were dry.
- Respiratory deep. The weight 9 kg.

Cont...

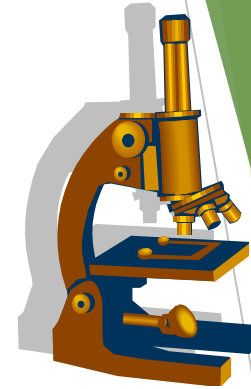


Degree of Dehydration

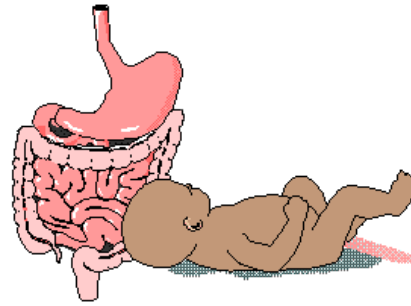
<u>Factors</u>	Mild < 5%	Moderate 5-10%	Severe >10%
<i>General Condition</i>	Well, alert	Restless, thirsty, irritable	Drowsy, cold extremities, lethargic
<i>Eyes</i>	Normal	Sunken	Very sunken, dry
<i>Anterior fontanelle</i>	Normal	depressed	Very depressed
<i>Tears</i>	Present	Absent	Absent
<i>Mouth + tongue</i>	Moist	Sticky	Dry
<i>Skin turgor</i>	Slightly decrease	Decreased	Very decreased
<i>Pulse (N=110-120 beat/min)</i>	Slightly increase	Rapid, weak	Rapid, sometime impalpable
<i>BP (N=90/60 mm Hg)</i>	Normal	Deceased	Deceased, may be unrecordable
<i>Respiratory rate</i>	Slightly increased	Increased	Deep, rapid
<i>Urine output</i>	Normal	Reduced	Markedly reduced

Laboratory Investigation

- Blood
- Stool specimen
- Rectal swab
- Culture blood no evidence of salmonella
- stool: no shigellae, yersinia or campylobacter



Cont...



	Result	Normal value
Peripheral blood count	Hb: 13.2g/dl, Hct 40%	Hb: 9.5-12.5, Hct 36%
White Cell Count	8200/mm ³	4-11*10 ³ /mm ³
Neutrophil	40% ↓	60%
Lymphocytes	55% ↓	31%
Monocyte	63% ↓	5%
Eosinophil	2% ↓	3%
Platelet count	300 * 10 ³ / mm ³	150-350 * 10 ³ / mm ³
Peripheral smear	normal	

Cont...

	Result	Normal value
Serum Na	128 mmol/l	135-148 mmol/l
K	2.8 mmol/l	3.5-5 mmol/l
Cl	95 mmol/l	99-111 mmol/l
Bicarbonate	10 mg/dl	20-25 mg/dl
BUN	40 mg/dl	25-40 mg/dl
Creatinine	0.5 mg/dl	0.2-0.4 mg/dl

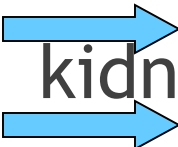
Acid-Base balance

➤ Acid intake/ production = Acid excretion.

➤ H^+ ions have a key role.

➤ Henderson-Hasselbach Equation:

- $PH = Pk + \log_{10} [base]/[acid]$
- $PH = 7.4 \pm 0.02$

➤ Acid carbonic lung.
Fixed  kidney.

Acid-Base Disorder

- Disease: Diabetes, COPD, Renal disease
- Metabolic Acidosis: HCO_3^- , H^+
- Metabolic Alkalosis: HCO_3^- , H^+
- Respiratory Acidosis: HCO_3^- , H^+
- Respiratory Alkalosis: HCO_3^- , H^+

Types of dehydration

	Isotonic (isonatremic)	Hypertonic (hypernatremic)	Hypotonic (hyponatremic)
Loses	$H_2O = Na$	$H_2O > Na$	$H_2O < Na$
Plasma osmolality	Normal	Increase	Decrease
Serum Na	Normal	Increase	Decrease
ECV ICV	Decrease maintained	Decrease Decrease +++	Decrease +++ Increase
Thirst	++	+++	+/-
Skin turgor	++	Not lost	+++
Mental state	Irritable/lethargic	Very irritable	Lethargy/coma
shock	In severe cases	Uncommon	Common

Management



- Non-specific
- Oral Rehydration Solution (ORS):
 - Effective in all types & all degrees of dehydration.
 - Can prevent dehydration if given early in the disease.
 - Cheap, easy to administer; can be given by mother at home.
 - No chance of overhydration or electrolyte overdose.
- Methods of administration: spoon, cup, dropper, syringe, naso-gastric tube or iv.

ORS Composition

- Sodium Chloride
- Tri-Sodium Citrate (bicarbonate)
- Potassium Chloride
- Glucose



Types of ORS



Solution	Glu g/dl	Na mEq/L	K meq/L	Cl meq/L
WHO	2.0	90	20	80
Rehydralyte	2.5	75	20	65
Pedialyte	2.5	45	20	35
Infalyte	2.0	50	20	40

Refeeding

- ▶ ORT: continue during diarrhea
- ▶ Continue breast feeding
- ▶ Formula fed :
 - ▶ Lactose free
 - ▶ Start with 1:1 dilution
 - ▶ Full strength after 6 - 24 hours of ORT

Refeeding

- ▶ Weaned Children
 - ▶ Avoid (24 - 48 hours):
 - ▶ Lactose containing foods
 - ▶ Avoid caffeine, raw fruits
 - ▶ Start refeeding with:
 - ▶ Rice, wheat noodles, bananas

Antidiarrheal Agents

- ▶ Anticholinergic agents
 - ▶ Ineffective
 - ▶ Contraindicated in children
- ▶ Absorbents agents
 - ▶ Kaopectate
 - ▶ Do not change duration or fluid loss

Antidiarrheal Agents

- ▶ Antisecretory Agents

- ▶ Bismuth Subsalicylate (pepto-bismal)

- ▶ Increases intestinal Sodium and water absorption
 - ▶ Blocks the effects of enterotoxins

re-

Antidiarrheal Agents

- ▶ Anti-motility Agents
 - ▶ Loperimide
 - ▶ Lomotil
 - ▶ Avoid in infants and children
 - ▶ Worsens bacterial infections

Prevention



- Wash your hands frequently, especially after using the toilet, changing diapers.
- Wash your hands before and after preparing food.
- Wash diarrhea-soiled clothing in detergent and chlorine bleach.
- Never drink unpasteurized milk or untreated water.
- Drink only bottled water.
- Proper hygiene.



Points to Remember

- Gastroenteritis is acute self-limited illness.
- Diarrhea and vomiting in infancy and childhood is usually due to viral gastroenteritis.
- Fluid replacement with ORS is the mainstay of management.
- Breast feeding should be continued, but formula feeding should cease until recovery.
- Antibiotics and antiemetics agents are contraindicated.



Thanks....

But it's not the
end !!!



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Case 2



Patient History:

Mr. Mansoor, a 21-year-old, presented to his GP with a 3 months of malaise, anorexia, weight loss, mild diffuse abdominal pain and diarrhoea.

Over the last fortnight he vomited every other day and had developed an itchy, blistering rash on the extensor surfaces of his knees and elbows.

He had not vomited any blood or had any obvious bleeding from the gut .

Recently, mealtimes were accompanied by bloating and he noted his stools were also paler than normal.

He was not taking any medication and had not travelled abroad. He was unable to recall any family history of disease.

Case 2



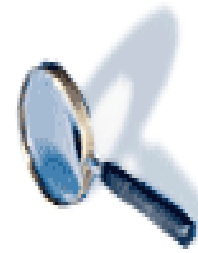
On examination, Mr. Mansoor was underweight for his height and had finger clubbing, several aphthous mouth ulcers and angular cheilitis.

He had a vesicular rash on the extensor surfaces of his elbows and knees. There was no jaundice or oedema, but he was clinically anaemic.

He had a mildly distended and non tender abdomen and normal bowel sounds.

No masses were felt on palpation or on rectal examination, and there was no evidence of per rectum bleeding. GP decided to refer Mr. Mansoor to a gastroenterologist for further evaluation.

Result of investigation



Blood test

- Hb (g/dl) 10.0 (13.5-18) ↓
- MCV (ft) 82 (78-96)
- MCH (pg) 25 (27-32) ↓
- Red cell folate (ng/l) 135 (160-640) ↓
- Serum B12 (ng/l) 426 (150-900)
- TIBC (mmol/l) 60 (45-72)
- TIBC saturation <10% ↓
- serum iron 7 mmol/l ↓

Cont...



- blood film microcytes
 oval macrocytes
 Howell-Jolly bodies
- Platelet count ($\times 10^9/l$) 280 (150-400) ↑
- WBC ($\times 10^9/l$) 15.2 (4-11) ↑
- Neutrophils ($\times 10^9/l$) 8.4 (2-7.5) ↑
- Eosinophils ($\times 10^9/l$) 0.46 (0.4-0.44) ↑
- Lymphocytes ($\times 10^9/l$) 9.9 (1.6-3.5)

Serum Immunoglobins

➤ IgG (g/l)	18.2 (5.4-16.1) ↑
➤ IgM (g/l)	0.4 (0.5-1.9) ↓
➤ IgA (g/l)	3.9 (0.8-2.8) ↑
➤ IgE (IU/ml)	51 (3-150)

Serum Electrolytes

➤ Sodium (mmol/l)	134 (134-145)
➤ Potassium (mmol/l)	↓ 3.4 (3.5-5)
➤ Calcium(ionised) (mmol/l)	↓ 1.65 (2.12-2.65)
➤ Phosphate (mmol/l)	1.26 (0.8-1.45)
➤ Chloride (mmol/l)	95 (95-105)
➤ Serum parathyroid hormon	0.98 (µg/l)

Liver function tests

➤ Serum albumin (g/l)	29 (35-50)	
➤ ALP (IU/l)	64(30-300)	↓
➤ AT (IU/ml)	37 (5-35)	
➤ Serum billirubin (μmol/l)	12 (3-17)	↑

Other investigation



- Prothorombin time (secs) ↑ 19 (10-14)
- APTT (secs) 55 (35-45) ↑
- Faecal fat (g/24 hr) ↑ 27(<6g/24hr)
- Faecal blood Trace
- Stool culture Negative
- Abdominal X-ray small bowel
 destension



Further Investigation

dermatitis herpetiformis

+

Malabsorption



Jejunal biopsy



- Positive (ELISA) tests for IgA antibodies to: gliadin, endomysium and reticulin

Management

- Gluten-free diet
- Calcium, folate and iron supplements
- After 3 months, Mr. Mansoor gained several kg in weight and the symptoms were improved.
- At a follow up appointment:
 - Gliadin, endomyosium and reticulin abs levels were lower.
 - Repeat biopsy showed improvement in the jejunal architecture.
 - Serum albumin, calcium, haemoglobin and coltting were within the normal level.

Points to Remember

- People with celiac disease can not tolerate gluten.
- Celiac disease damages the small intestine leading to malabsorption.
- Treatment is important because people with celiac disease could develop complication like cancer, anemia and osteoporosis.
- A person with celiac disease may or may not have symptoms.
- Because celiac disease is hereditary, family members of a person with celiac disease may need to be tested by blood and biopsy.
- For celiac disease, gluten-free diet is a lifetime requirement.

*Thank You for Being
Patient Till the End*



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