Diarhea of infectious origin

Diarhea (diarrhoea)

- abnormal faecal discharge characterised by two or more fluid stools daily or one fluid stool containing blood, mucus or pus
- change in frequency, consistence, colour or volume of stool, involving increased fluid and electrolyte loss

Etiology – infectious causes:

Temperate climate area:
Bacteria: *Salmonella spp., Campylobacter jejuni, Shigella sonnei + flexneri, E.coli, Yersinia enterocolitica, Clostridium difficile,*
toxins - *Staphylococcus aureus, Bacillus cereus, Clostridium perfringens, Clostridium botulinum*
Viruses: rotaviruses, small round viruses incl. Norwalk virus, adenoviruses, astroviruses, caliciviruses, coronaviruses
Parasites: protozoa – *Giardia lamblia, Balantidium coli, Cryptosporidium* (immunodeficient pts.)
Fungi : *Candida* (in immunodeficient)

Tropical and subtropical area:
Bacteria: *Vibrio cholerae*, ETEC, *Shigella dysenteriae*
Parasites: *Entamoeba histolytica, Schistosoma spp.*

Etiology – noninfectious causes:

Anatomical disorders**:**

- colorectal carcinoma
- proctocolitis
- Crohn´s disease
- diverticulitis
- acute appendicitis
- bowel invagination
- a. mesenterica thrombosis
- post-resection bowel syndrome
- small pelvis diseases (e.u. gravidity, periproctal abscess)

Disorders with no macroscopical anatomic cause:

- dietary mistakes, food intolerance
- malabsorption syndromes of various etiology
- hormonal dysbalance (carcinoid, hyperthyreosis, Addison´s disease)
- „nervous“ diarhea (irritable colon)
- chemical poisoning (mercury)
- drugs (kolchicin, laxatives)
- post-radiation colitis
- microangiopathia (diabetic, uremic colitis, Henoch-Schönlein purpura)

Terminology:

Gastroenteritis – (inflammatory) disorder of stomach and small intestine
- nausea, vomiting, diarhea, epigastric pain, abdominal discomfort

Enteritis – (inflammatory) disorder of small intestine
- diarhea, diffuse abdominal pain

Enterocolitis – inflammatory disorder of both the small and large intestine
- diarhea, blood and mucus in stool, fever, diffuse or colicky abdominal pain

Dysentery – inflammatory disorder of the large intestine
- diarhea, blood, pus and mucus in stool, fever, left-sided pain, abdominal cramps, tenesms (painful urge with passing no stool but blood)

Classification of GIT infections:

1. Food poisoning (alimentary intoxication)

- ingested food already contains bacterial toxins
- IP short 2-6 hours, rapid and short course, self-limiting
- initially and more pronounced vomiting, subsequent diarhea may be watery, no blood or mucus, mild or no fever

2. „Propper“ gastrointestinal infections

- ingested food contains agents which multiply in GIT
- IP and clinical course is longer (days)
- vomiting, diarhea more severe, often with blood and mucus, fever

Pathogenesis of GIT infections:

1. Food poisoning (alimentary intoxication)

- ingested food already contains bacterial toxins, which
  - either stimulate secretion:
  Staphylococcus aureus, Bacillus cereus, Clostridium perfringens type A,
  - or cause distant symptoms: *Clostridium botulinum*

2. „Propper“ gastrointestinal infections

- pathogens adhere to mucosa with minimum pathogenic effect: *Giardia*, EAEC
  - asymptomatic or mild symptoms, malabsorption may develop
- adhere to mucosa and elaborate toxins, which stimulate fluid secretion: *Vibrio cholerae*, ETEC, some *Salmonella* strains
  - watery diarhea, water and electrolyte loss
- destruct microvilli, without invasion to cells: EPEC
  - diarhea, frequently with blood, fever, diffuse abdominal pain
- pathogens invade mucosa and cause ulcers: *Shigella*, EIEC, rotavirus
  - diarhea with blood and mucus, abdominal pain, fever
- invade submucosal tissue (ileocaecal area), pass to mesenterial lymph nodes and cause mesenterial lymphadenitis, rarely sepsis: *Campylobacter, Yersinia, Salmonella*
  - diarhea with blood, abdominal pain, fever
- invade submucosal tissue and cause no diarhea but systemic disease: *Salmonella typhi abdominalis*
  - fever, headache, malaise, confusion etc.

Pathogenesis of diarhea:

2 mechanisms: action of toxins or invasion of GIT tissues

enterotoxins:
specific region of enterotoxin attaches to host cell-membrane receptors
chain of reactions leads to formation of excessive amounts of c-AMP
epithelial cells (enterocytes) over-secrete electrolytes and water

invasion of GIT tissues – see above

Clinical course
is determined by:

- invasivity of microorganisms – see above
- infecting dose
- host defences

Infecting dose = a quantity which causes illness:
10^1-10^2 shigella, entamoeba, giardia
10^2-10^6 campylobacter
10^5 typhoid fever
10^7-10^{10} gastroenteric salmonellae
10^8-10^{10} vibrio cholerae

Host defences:

- gastric acidity – decreased acidity enables pathogens to survive (chronic atrophic gastritis, gastric carcinoma, gastric surgery, antacids, infants)
- vehiculum containing pathogens and speed of gastric emptying (fluids dilute gastric acid and quickly pass to duodenum)
- immune response – physiological bowel microbial flora (produces bacteriocins, competes for nutrients), secretory IgA, serum Ig

Diagnosis:

History:

- epidemiological data:

- food: eggs, meat, milk products, insufficiently boiled ...salmonellosis, poultry ...campylobacteriosis
- lower hygiene standard ...shigellosis
- home-made pork products (sausages) ...yersiniosis
- travelling in tropical and subtropical world
- close contact with acute infectious diarhea in the family

- current illness:

stool – frequency, consistency, blood, mucus, tenesms
vomiting – frequency, blood
fever
fluid intake and output – urination
malaise, collapse, other symptoms

Physical examination:

- hydration:

oral mucosa, skin turgor, diuresis, body weight (infants!), fluid intake

- circulation:

puls rate and quality, blood pressure, peripheral perfusion (cold acra)

- abdomen:

distension, pain on palpation, resistence, sounds

Features of dehydration:

hyponatremic, isonatremic (dehydration from diarhea and vomiting; decreased sodium, bicarbonate, potassium)
- mild: increased thirst, reduced urine output
- severe: decreased skin turgor and elasticity, sunken eyes, dry mucous membranes, apathy, sunken fontanelle in infants

hypernatremic (due to excessive salts in feeds or rehydration fluids, usually in children; raised sodium, normal or reduced bicarbonate and potassium)
extreme thirst, restlessness, irritability, convulsions
skin turgor may appear normal (doughy feel to the skin), conjunctival injection

Laboratory diagnosis:

- etiology
- dehydration
- inflammation

<u>Etiology:</u>

Rectal (anal) swab for culture:
Salmonella, Shigella, Campylobacter (selective media) Yersinia (grows slowly, under cold temp) E.coli (subsequent slide agglutination for serotype) Vibrio cholerae (alkaline peptone water)

Stool sample for:
electronmicroscopy – viruses
latexagglutination – viruses, Cl. difficile antigen
ELISA – toxin (Cl. difficile)
parazitology – microscopy – Entamoeba, Giardia, Schistosoma

Blood for serology – extraintestinal forms of GIT infections – Yersinia, Entamoeba, Salmonella (Widal test)

<u>Dehydration</u>
blood count (hematocrit)
urea, creatinine, natrium, potassium, chlorine ions, osmolarity
pH, base excess – deficit
glycaemia

<u>Inflammation</u>
ESR, leukocytes + differential count, CRP

Treatment:

Hospitalisation if:

- severe dehydration: hypotension, tachycardia, malaise, confusion, collapse, oliguria – anuria
- no or low oral fluid intake or persistent vomiting
- diarhea > 3 days with pathological containt, tenesms
- severe abdominal pain or distension
- severe underlying disease
- insufficient home care

Principles of treatment:

- rehydration
- cleaning of the bowel
- systemic treatment with antimicrobials
- relief of symptoms

Rehydration

- **peroral**: mineral water, tea (with sugar), ORS = oral rehydration solution – various recipes:

WHO sol: Na 90, K 20, HCO_3 30, Cl 80, glucose 111mmol/L
NaCl 3,5, trisodium citrate 2,9, KCl 1,5, glucose 20g in 1 L water
Our hospital solution: NaCl 2,4, KCl 1,1, $NaHCO_3$ 1,7, G 27g in 1L water
Home-made solution: 1 table-spoon of sugar + 1 tea-spoon of salt + orange juice + 1 L boiled water
drink cold, small amounts frequently

- **parenteral:**

initially „physiological" solution (0,9% NaCl, F1/1) or Hartmann sol. 500ml + 500ml, in subsequent infusions replace potassium reflecting detected depletion
carefully rehydrate older persons, cardiacs – risk of heart congestion, pulm. edema
prevailing vomiting – hypochloremia, metabolic alkalosis
- „physiological" solution F 1/1 (0,9% NaCl)
prevailing diarhea – hyponatremia, hypokalemia, hypochloremia
- Hartmann sol. H 1/1, supplementation of K^+

Cleaning of the bowel:

- **diet**

acute diarhea – low-fibre, low-fat food: white bread, rolls, biscuits; potatoes, rice, carrot – soup or puree; banana, mashed apple – puree
when improving (decreasing frequency and fluidity): pasta, low-fat meat, broth, canned fruit – appricots
slow gradual changeover to normal food
avoid high-fat, fried, spicy food, alcohol, fresh fruit and vegetable (except banana and apple), milk, chocolate

- **intestinal disinfectants** – chloroxin
- **adsorbents** – medicinal charcoal – efficient only in upper GIT, diosmectit (Smecta), calcium carbonicum, bismuth subsalicylate

Restoring of the normal bowel microbial flora:
- **probiotics**

Lactobacillus acidophilus, Bacillus subtilis, E.coli strain Nissle*, Saccharomyces boulardii*

Systemic treatment with antibiotics:
- severe course of disease – persistent fever and diarhea
  - known etiology:

salmonella, yersinia – cotrimoxazole, fluoroquinolones
campylobacter – macrolides, fluoroquinolones, tetracyclines
shigella – sensitivity varies, ampicillin, COT, FQ, TET
  - unknown etiology: cotrimoxazole, (fluoroquinolones)
- epidemiological reasons – to shorten duration of infectivity and stop transmission to other persons:
  - shigellosis (esp. food-handlers), cholera, amebiasis
  - typhoid fever, paratyphoid fever

salmonellosis – ATB treatment may finally prolong the stool positivity

Relief of symptoms:
antiemetics:
metoclopramid (Cerucal, Degan), domperidone (Motilium)
phenothiazins – prochlorperazine, thiethylperazine (Torecan)
antimotility drugs not suitable, as diarhea is a self-cleaning mechanism of the bowel; can be used in very proffuse diarhea only temporarily to decrease frequency diphenoxylate (Reasec), loperamide (Imodium), opium tincture
! never in bloody diarhea – decreased peristalsis…raised absorption of bacterial toxins…paralytic ileus…toxic megacolon
antipyretics
spasmolytics

Pseudomembranous colitis
= pseudomembranous inflammation of the colon mucosa caused by *Clostridium difficile* toxin

Antibiotic-associated diarhea
- diarhea associated with antibiotic treatment, which inhibits normal gut microbial flora and thus enables the non-sensitive flora (*Candida, Clostridium difficile)* to overgrow
- a milder version of pseudomembranous colitis

Any antibiotic drug may precipitate the disease; most potent are clindamycin, broad-spectrum penicillins and cephalosporins

Spectrum of the disease severity:
- antibiotic-associated diarhea – simple diarhea
- pseudomembranous colitis
- toxic megacolon

Clinics: watery diarhea, subsequently with blood, low-grade fever, abdominal pain

Diagnosis:

detection of toxin in the stool – ELISA
(confirmation of the toxic effect in tissue culture is not routine)
biopsy of colonic mucosa – typical histological changes
culture isolation (difficult), detection of antigen (latexagglut.) – does not make dg., as *C.d.* is carried by up to 30 % pts.

Treatment:

- discontinue precipitating ATB
- diet, rehydration
- causative ATB:
  metronidazol 250-500mg q 8 h oral and/or i.v. (if decreased peristalsis or ileus) for 7d
  vancomycin 125-250mg q 6 h oral! for 7d

10-20 % relapse, repeat the ATB course for 14-21d

Acute diarhea in children 0 – 3 years

Etiology: viruses - rotavirus, adenovirus
bacteria - salmonella, EPEC, campylobacter
Rotavirus gastroenteritis – moderate to severe course with high fever, vomiting and diarhea with blood and mucus, tendency to dehydration.
Similar course in **EPEC (O26:H111, O157:H7).**

In infants:
carefully check the body-weight
consider possible bowel invagination if diffusely painful and distended abdomen and bloody mucus on digital rectal examination

Treatment:

diet and rehydration:
breast-fed baby: no vomiting – continue breast-feeding, if severe diarhea – interrupt BF temporarily and feed with rice or carrot soup
bottle-fed baby: start with „water pause“ = tea and ORS, continue with rice and carrot soup and later low-fat milk, banana and apple puree; procede gradually to normal feeding with milk
rehydration via nasogastric tube in infants vomiting or refusing feeding: ORS, rice and carrot „soup“
parenteral rehydration requires an estimate of fluid and electrolyte losses and of the appropriate normal daily fluid intake for the patient´s age (infants: 150-100ml/kg/24h)

drugs:
bowel disinfectants: chloroxin suspension (since 6 m.)
oral antibiotics in severe course:
- cotrimoxazol – esp. for suspected salmonellosis
- gentamicin – EPEC
- macrolide only for confirmed campylobacter

warm wet bandage recommended for abdominal pain, if acute abdomen excluded