

**Infections of the gastrointestinal tract**  
**Infections of the urinary tract**  
**Sepsis**

Mark Svebis

1st Department of Internal Medicine

Semmelweis University

# Antibiotics in generally

- the most successful drugs, but!
- narrowing indications and increasing side effects:
- Clostridium difficile colitis, antibiotic-associated diarrhea, growing antibiotic resistance, environmental pollution (agriculture)

- Do not give antibiotics in case of:
- viral infections (tonsillopharyngitis)
- asymptomatic bacteriuria
- toxin induced gastroenteritis (food-poisoning)
- Exceptions?
- neutropenia, pregnancy, cholera (for controlling the epidemic)

# Infectious gastroenteritis.

## Definitions

- Diarrhea: passage of loose or watery stools at least 3 times in a 24-hour period
- Acute diarrhea: persist < 14 days
- Persistent diarrhea: persist 14-30 days
- Chronic diarrhea: persist > 30 days
- Dysentery = invasive diarrhea: diarrhea with visible blood or mucus

# Symptoms of gastroenteritis

- Loss of appetite, nausea, vomiting
- Diarrhea (watery/bloody)
- Abdominal pain, tenesmus
- Fever
- Weakness, lethargy
- Muscle pain
  
- The most severe complication is dehydration: decreased skin turgor, tachycardia, hypotension, altered mental status.
- Children are in higher risk of dehydration.

# Pathophysiology of gastroenteritis

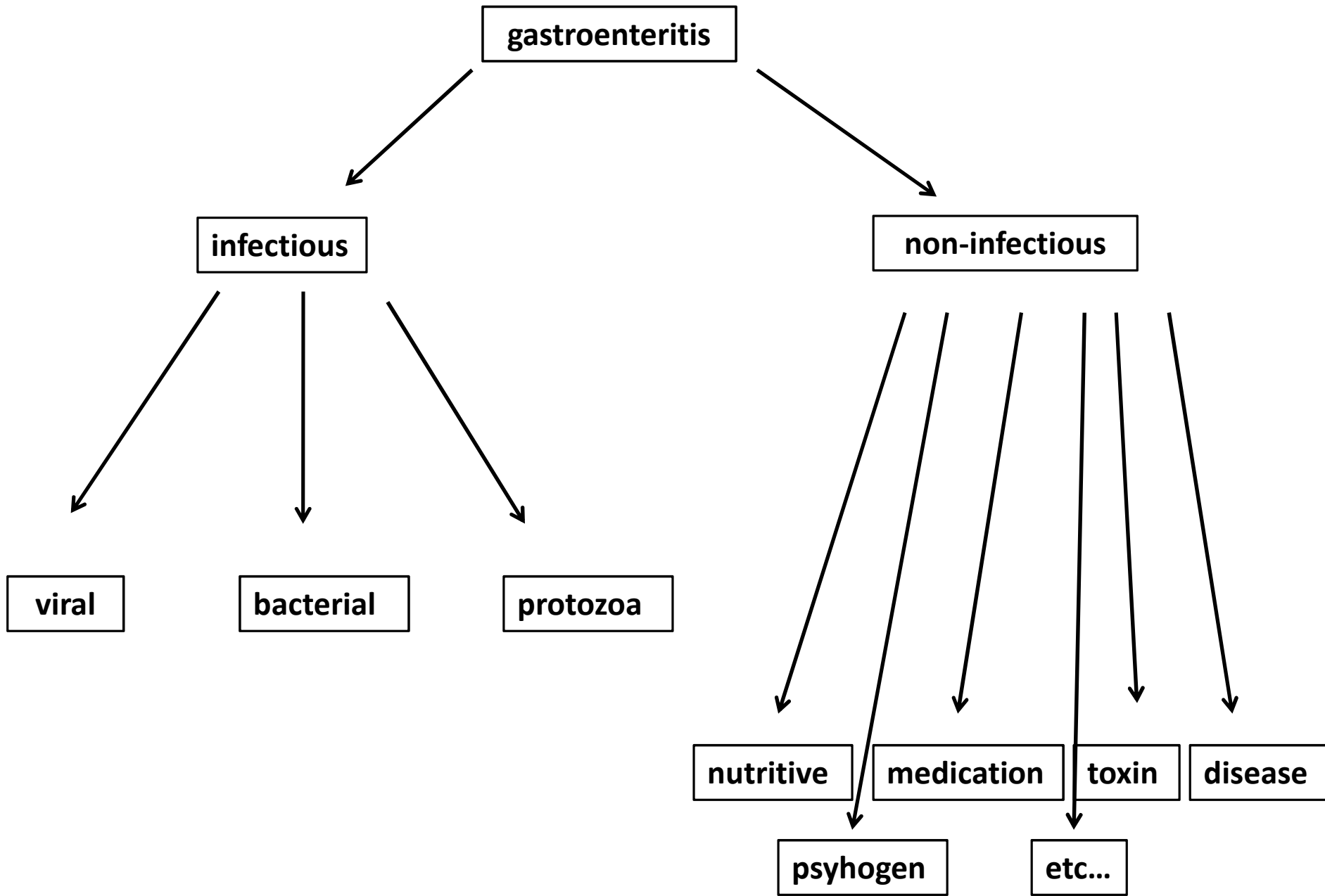
## 1.) Non-inflammatory gastroenteritis

- Mostly effect the small intestines
- No anatomical changes
- Increased secretion or decreased absorption
- Watery diarrhea without blood
- Leucocytes are missing in the stool
- Caused by viruses (most commonly), bacterial toxins (e.g. *Vibrio cholerae*), protozoa (e.g. *Giardia lamblia*)
- Usually less severe than the inflammatory type (but e.g. *Vibrio cholerae* infection has a high mortality)

# Pathophysiology of gastroenteritis

## 2.) Inflammatory gastroenteritis

- Mostly effect the large intestines
- Invasive infection
- Destruction of the mucosa layer (anatomical changes)
- Dysentery: blood or mucus in stool
- Leucocytes in the stool (sometimes even pus in stool)
- Fever, tenesmus
- Caused by bacterias (Shigella, Salmonella, Campylobacter, Yersinia, EIEC, EHEC)
- Entamoeba histolytica is the only protozoa that can cause dysentery
- Usually more severe than the non-inflammatory type





# Infectious gastroenteritis.

## Transmission

- Mostly by oral route:
  - contaminated water
  - unwashed food
  - unwashed hands
  - fecal-oral route (animal/human)
- By respiratory route (aerosolization)
  - Adenoviruses (fecal-oral route as well)
  - Caliciviruses (e.g. Noroviruses)

# Medical history (anamnesis)

- Previously taken food and drinks
- Others are affected? (e.g. in family, in school)
- Travel history (e.g. subtropic-tropic countries)
- Use of swimming pool
- Previous hospitalization (Clostridium difficile)
- Previous antibiotic treatment (Clostridium diff.)
- Current medications
- Acute / persistent / chronic diarrhea

# Viral gastroenteritis

- non-inflammatory gastroenteritis type
- the most common cause of gastroenteritis
- transmitted by fecal-oral route (Rotaviruses, Astroviruses) or by respiratory route (Adenoviruses, Noroviruses)
- mostly vomiting and diarrhea are both present, but either can occur alone
- high frequency of vomiting
- fever (50% of cases)
- mild diffuse abdominal tenderness
- watery diarrhea without blood
- usually lasts for 3-8 days
- mostly healed without medical treatment

# Notice!

- Viral gastroenteritis-like symptoms (vomiting, diarrhoea, mild diffuse abdominal pain) can mimic the early stage of
  - appendicitis
  - diabetic ketoacidosis
  - acute onset of inflammatory bowel disease (Crohn, ulcerative colitis)

# Viral gastroenteritis

## Treatment

- Increased salt and water needs
- Milk and dairy products are advised to avoid
- Strict diet is not needed (eat as tolerated)
- Antibiotic treatment is harmful!
- Probiotics have a modest effect
- Oral rehydration therapy (ORT)
- Use antimotility agents in case of severe diarrhea
- Use antiemetic agents, when oral rehydration therapy is not tolerated

# Oral rehydration therapy (ORT)

- Oral route is preferred than intravenous in mild and moderate dehydration
- Oral Rehydration Solutions (ORS): contain water, salt and sugar
- Even in small intestine enteritis, the intestinal glucose absorption by sodium-glucose cotransport remains intact mostly
- → if salt and glucose are both present, they assist to absorb water from the lumen

# ORS

- Isotonic ORS with equimolar concentrations of glucose and sodium is as effective as intravenous hydration in case of mild and moderate hypovolaemia
- High rate of glucose → unabsorbed glucose increase the osmolality in lumen and decrease water absorption
- High rate of sodium → may cause hypernatraemia, and unabsorbed sodium increase the osmolality in lumen
- Home-made ORS: 1 teaspoon salt + 8 teaspoon sugar + 1 liter water + 1 cup of orange juice

- Moderate dehydration is advised to treat with standard ORSs (e.g. Rehydralyte, Normolyt, etc...)
- Common beverages are not advised to use
- Severe hypovolaemia must be treated by intravenous rehydration in hospital
- Diarrheal disease is still one of the leading cause of childhood mortality - mostly in developing countries
- Early and appropriate ORS helped to decrease the mortality of gastroenteritis (e.g. cholera)



# Toxin induced gastroenteritis

- Staphylococcus, Bacillus cereus, Clostridium perfringens, Clostridium botulinum
- Caused by preformed toxins, not real infections
- No fever! Early onset (<12 hours after meal), except botulism (> 12 hours – till few days)
- Antibiotic treatment is harmful (they don't affect on preformed toxins). Antitoxin in case of botulism.
- Th: Oral Rehydration Therapy

# Bacterial gastroenteritis

## 1. Salmonella typhi and Salmonella paratyphi

- Typhus abdominalis / typhoid fever
- Salmonella paratyphi / paratyphoid fever is less severe
- Systemic infection with bacteraemia
- Diarrhea and vomiting is missing!
- High fever, abdominal pain, constipation
- Complications: intestinal hemorrhage, perforation
- Blood culture and stool sample
- Antibiotic treatment: fluoroquinolones, iv. ceftriaxone or azithromycin

## 2. Salmonellosis

- Most common cause is *Salmonella enterica*
- Dysentery (and not systemic infection!)
- Fever, abdominal pain, vomiting
- Typically lasts for 4-7 days
- Antibiotic treatment is not indicated, because it prolongs the defecation of *Salmonella*
- Antibiotic treatment is needed in case of severe disease or prosthesis implantation (joint, heart valve)
- Fluoroquinolones or iv. ceftriaxone

### 3. Campylobacteriosis, Shigellosis, Yersiniosis, E.coli (EHEC, ETEC, EPEC, EIEC), travelers' diarrhea, Entamoeba histolytica

- Dysentery
- Antibiotics prolong the restoration of normal microbiom, and also increase the risk of HUS (EHEC)
- → Generally antibiotic treatment is not advised, just in case of severe or long lasting disease.
- But Entamoeba infection should be treated (metronidazol)
- Antibiotics: fluroquinolons, azithromycin, ceftriaxone, trimetophrim-sulfamethoxazole (TMP-SMX) or rifaximin
- **In case of all dysentery, the isolation of the patient and taking stool culture is necessary!**

# 4. Clostridium difficile

- Gram-positive, anaerob, spore-forming bacteria
- Leading cause of dysentery in hospital
- Mostly occur after antibiotic treatment
- Colonizes the human colon, high chance of relapse
- Greenish, mucous diarrhea
- Treatment: p.o. metronidazol or p.o. vancomycin for 10-14 days (iv. vancomycin has no effect on Clostridium difficile colitis)
- p.o. vancomycin is superior to metronidazol, because vancomycin is not absorbed → high concentration can be achieved in the colon
- After the 2nd relapse: fecal microbiota transplant (FMT) is advised

# Prevention of gastroenteritis

- Washing hands
- Isolate patients
- Use bottled water in developing countries

# Urinary tract infections (UTI)

- Urinary tract: urethra, bladder, ureters, kidneys
- Lower-urinary tract infections are common infections in women (shorter urethra, urethra is close to the anus)
- Urethritis often associated with sexually transmitted infections in women (urethra is close to the vagina)
- UTIs are mostly caused by enteric Gram-negative rods (E.coli, Kleb.pneumoniae), but urethritis is often caused by sexually transmitted agents (Mycoplasma, Chlamydia, Neisseria gonorrhoea, Herpes simplex)
- Symptoms of UTI: burning pain when urine, frequent urge to urinate, strong-smelling urine, cloudy urine, bloody urine

# Types of urinary tract infections

## Anatomical classification

Urethritis	Discharge Burning pain when urine	Lower urinary tract infection
Cystitis	Frequent, painful urination Suprapubic pain Blood in the urine (hematuria)	
Pyelonephritis (acute)	High fever, shaking Nausea, vomiting Flank pain Costovertebral angle tenderness	Upper urinary tract infection



# Types of urinary tract infections

## Clinical classification

- Uncomplicated and complicated UTI
- Definition of complicated UTI may differ between societies
- 1.) The „real“ uncomplicated UTI:
- acute simple cystitis in nonpregnant premenopausal healthy women
  - empiric antibiotic treatment: fosfomycin for 1 day, nitrofurantoin for 5-7 days, other systemic antibiotics for 3 days
  - avoid fluoroquinolons if possible (growing resistance)
  - urine culture is not necessary
- In any other cases, taking urine culture is necessary
- But recurrent urinary tract infections (>2 cystitis/6 months) even in nonpregnant premenopausal healthy women are categorized as complicated UTIs
- Acute cystitis in men are rare → taking urine culture and abdominal ultrasound (searching for anatomical abnormalities) is necessary

- In case of upper urinary tract infection (even in healthy nonpregnant women) hospitalization is recommended
- Urine and blood culture
- Abdominal ultrasound (searching anatomical abnormalities)
- Iv. antibiotic treatment for min. 7 days

# Complicated UTI

- Anatomical abnormalities (eg. ureter stricture, vesico-urethral reflux, )
  - Functional abnormalities (vesico-urethral reflux)
  - Metabolic abnormalities (diabetes, pregnancy)
  - Catheter-related infections
- 
- Complicated UTIs are associated with recurrent infections and have a higher risk for treatment failure

# Antibiotic treatment in UTIs

- Aminopenicillins, 2nd and 3rd generation of cephalosporins, fluoroquinolones, aminoglycosides (only iv.)
- Nitrofurantoin and fosfomycin can be chosen only in uncomplicated lower urinary tract infections
- **High amount of fluid intake is mandatory to wash out the bacterias and help the healing**

# Sepsis

- One of the leading cause of death
- Overwhelming and life-threatening reaction to infection
- Severe disease, must be treated in hospital
- Previous criteria: SIRS + infection
- From 2016: infection + signs of organ failure
- Organ failure: > 2 score increase in the SOFA (Sequential /Sepsis-related Organ Failure Assessment )

# SOFA online calculator

## SOFA Calculator

Sequential Organ Failure Assessment (SOFA) severity of illness score for hospital mortality

[ClinCalc.com](#) » [Critical Care](#) » Sequential Organ Failure Assessment (SOFA) Calculator

Use the worst value for each physiological variable within the past 24 hours.

Respiration	
FiO <sub>2</sub>	<input type="text"/> %
PaO <sub>2</sub>	<input type="text"/> mmHg
Mechanical ventilation	<input type="button" value="No"/> <input type="button" value="Yes"/>
Coagulation	
Platelets	<input type="text"/> x10 <sup>3</sup> /mm <sup>3</sup>
Liver	

# Quick SOFA

- for bedside use
- quickSOFA (qSOFA): maximum 3 score
- 1 score:  $> 22/\text{min}$  respiratory rate
- 1 score: altered mental state, GCS  $< 15$
- 1 score: SBP  $\leq 100$  Hgmm

# Septic shock

- Despite adequate fluid resuscitation the MAP (mean arterial pressure)  $< 65$  Hgmm
- serum lactate level  $> 2$ mmol/l
- Very high mortality



# Treatment of sepsis

- Early goal-directed therapy to maintain the circulation
- Early high dose intravenous infusion (30ml / bodyweight in 3 hours)
- The golden hour: broad-spectrum antibiotic must be given in the first hour
- Take 2x2 pairs of blood culture
- Procalcitonin (PCT) level is a useful biomarker to diagnose and to follow-up sepsis
- CRP level can be used neither in the diagnose of sepsis, nor in the follow-up of it (half time is ~ 48 hours, and serum CRP level can be even normal in sepsis)
- Strict follow-up of the patient (consider to call the ICU)