Gastrointestinal Parasitic Infections

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Gastrointestinal Parasitic Infections

Parasitism:
- Non-mutual relationship (undesired by the host)
- The parasite benefits at the expense of the host

Traditional use of the term parasite:
- Organisms with life stages that needed more than one host
- These parasites are now called macroparasites

By stringent use of the definition:
- Bacteria and viruses also benefit from a host
- These parasites are called microparasites
- Directly transmitted between hosts of the same species
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Macroparasites (or traditional parasites):

Macroparasites are eukaryotes, while microparasits are prokariotes

⇒ What structure discriminates eukaryotes from prokaryotes?
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What structure discriminates eukaryotes from prokaryotes?

Eukaryotes are species with cells containing a nuclear membrane

References
Gastrointestinal Parasitic Infections

Parasitic eukaryotes can be divided into two subgroups:

→?
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Parasitic eukaryotes can be divided into two subgroups:

- **Protozoans** (mostly single cell eukaryotic organisms)
  - systemic eosinophilia not mandatory

- **Helminthes** (‘worms’, organisms containing gazillions of eukaryotic cells)
  - systemic eosinophilia normally present
Gastrointestinal Parasitic Infections

Parasitic eukariotes can be divided into two subgroups:

- Protozoa (mostly single cell eukaryotic organisms)

- Helminthes (‘worms’, organisms containing gazillions of eukaryotic cells)

  Parasitic helminthes: further subdivision into 3 groups

  \( \rightarrow ? \)
Gastrointestinal Parasitic Infections

Parasitic eukaryotes can be divided into two subgroups:

- Protozoa (mostly single cell eukaryotic organisms)

- Helminthes (‘worms’, organisms containing gazillions of eukaryotic cells)

  1) Neomatodes (engl: roundworms; germ: Fadenwürmer)

  2) Trematodes (engl: flatworms, flukes; germ: Saugwürmer)

  3) Cestodes (engl: tapeworms, germ: Bandwürmer)
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Can we complete the puzzle?
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Protozoa?
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Protozoa:

- **Giardiasis** (Giardia lamblia)
- **Amoebiasis** (Entamoeba histolytica)
- **Cryptosporidiosis** (Cryptosporidium hominis, C. parvum)
- **Microsporidiosis** (Encephalitozoon intestinalis, Enterocytozoon bieneusi)
- **Cyclosporiasis** (Cyclospora cayetanensis)
- **Isosporiasis** (Isospora belli)
- **Dientamoeba fragilis** (pathogenicity facultative)
- **Balantidiasis** (Balantidium coli)
- **Balstocystosis** (Blastocystis hominis, pathogenicity controversial)
- **Trypanosomiasis** (South America [Chagas Disease]: Trypanosoma cruzi; Africa [sleeping sickness]: T. brucei gambiense or T. brucei rhodesiense)
Gastrointestinal Parasitic Infections

Helminthes, Neomatodes (engl: roundworms; germ: Fadenwürmer):

- Anisakiasis (Anisakis simplex)
- Ankylostomiasis (Ancylostoma duodenale, Necator americanus) - hookworm
- Ascaris-Infection (Ascaris lumbricoides)
- Capillariasis (Capillaria philippinensis)
- Enterobiasis [syn. Oxyuriasis] (Enterobius vermicularis) - pinworm [US], threadworm [UK], seatworm [UK], Medenwurm [D/CH]
- Strongyloidiasis (Strongyloides stercoralis, S. fülleborni) – pinworm [non-US]
- Trichuriasis (Trichuris trichuria) - whipworm
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Helminthes, Trematodes (engl: flatworms, flukes; germ: Saugwürmer)

- **Echinostomiasis** (Echinostoma ssp.)
- **Fasciolopsiasis** (Fasciolopsis buski)
- **Heterophyasis** (Heterophyes heterophyes)

Trematodes primary affecting the liver or other organs:
- **Schistosomiasis** (Schistosoma mansoni, S. japonicum, S. mekongi) – Bilharziose [D/CH]
- **Fasciolosis** (Fasciola hepatica, F. gigantica)
- **Chinese liver fluke disease** (Clonorchis sinensis)
- **Cat liver fluke disease** (Opistorchis felineus)
- **South east asian liver fluke disease** (Opistorchis viverrini)
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Helminthes, Cestodes (engl: tapeworms, germ: Bandwürmer)
- Taeniasis [asymptomatic] and cysticercosis [invasive] (Taenia solium, T. sanguinata) – cysticercosis is mediated by T. solium eggs
- Diphyllobothriasis (Diphyllobothrium latum)
- Hymenolepis nana – Zwergbandwurm [D/CH]

Cestodes primary affecting the liver or other organs:
- Cystic/unilocular echinococcosis (Echinococcus granulosus) – hyatid disease
- Alveolar echinococcosis (Echinococcus multilocularis) – hyatid disease
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Treatment – what drugs do we have at ours disposal?
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Treatment – what drugs do we have at our’s disposal?

Traditional antibiotics: Metronidazole (CH: Flagyl®), Co-Trimoxazole (CH: Bactrim forte®), Ornidazole (CH: Tiberal®), Paromomycine (Humatin®)

In HIV-Infection: HAART

Benzimidazoles: Mebendazole (CH: Vermox®), Albendazole (Zentel®)

Not approved for human use in Switzerland:
Praziquantel (Biltricide®, needs approve from Swissmedic), Ivermectin, Bithionol, Triclabendazole, Pyrantel pamoate, Fumagillin
Gastrointestinal Parasitic Infections

Treatment – which drug for which bug? – a rule of thumb
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Treatment – which drug for which bug? – a rule of thumb

- Protozoans:
  Metronidazole (except HAART in HIV and/or Co-Tritoxazole for Cryptosporidia, Cyclospora, and Albendazole for Microsporidia)

- Helminthes:
  Neomatodes: Albendazole/Mebendazole (except surgical excision for Anisakiasis)
  Cestodes: Praziquantel (except Albendazole in echinococcosis)
  Trematodes: Praziquantel
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Empiric treatment – does it have any rationale?
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1979-1981: ‘Boat People’ – after the Vietnam war, 12’000 immigrants, mostly from south Vietnam arrived in Switzerland
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1979-1981: 12’000 immigrants, mostly from south vietnam arrived in CH

- > 50% abdominal presented with discomfort

- Initially all got full work-up

- But most suffered from parasitic infection: pragmatic approach
  - 1st Appointment: shake hand, recipe for Mebendazole
  - 2nd Appointment: work-up if symptoms persist [1]
- Approach is still in use [2,3]

References
1.: Unpublished data
Specific Parasitic Infections
Specific Parasitic Infections

Disclaimer:

1) All treatment proposals are meant for adults and not for children
2) If multiple treatments were possible, we used the best treatment for which the specific drug is available in Switzerland
3) At our best knowledge, the treatment proposals reflect the evidence available in 2013
4) The information provided is partly abbreviated and therefore this compilation does not pretend to be complete in all details

Before treating a patient please do not ‘blindly’ refer to this presentation
Specific Parasitic Infections
Protozoa

Giardiasis – Giardia lamblia:
- Epidemiology: world wide
- Prevalence: 4-7% of diarrhoea [US]
- Risk factors: children <5 years, persons related to children, backpackers
- Transmission/host: contaminated food, soil, or water
- Symptoms: violent diarrhea, excess gas, stomach or abdominal cramps, upset stomach, and nausea
- Diagnosis: traditionally 3 stool samples, newer approaches: ELISA or direct fluorescence antibody testing (both with a sensitivity and specificity between 90% to 100%)
- Treatment: first-line treatment Metronidazole (Flagy®)
  250mg 3x/d for 5-7 days

References
Specific Parasitic Infections
Protozoa

Amoebiasis – Entamoeba histolytica:
- Epidemiology: global distribution, high prevalence in countries with poor socioeconomic and sanitary conditions
- Prevalence: 4% in US, 10% of them with invasive disease; 50% in South America, Africa, and Asia
- Risk factors: 90% asymptomatic, 10% symptomatic of them 4% with liver abscess
- Transmission/host: human to human (e.g. water/food)
- Symptoms: mild diarrhoea, bloody dysenteria, fever and pain in liver abscess
- Diagnosis: traditionally 3 stool samples (sensitivity 57% / specificity 14%) but stool testing can not distinguish E. histolytica and E. dispar (the latter is apthogen) → ELISA (41% / 87%) or PCR from stool (sensitivity 93% /99%)
- Treatment: dysenteria: dysenteria: Metronidazole 500mg 3x/d for 5-10 days, liver abscess: Metronidazole 750mg 3x/d for 10 days (and consider aspiration)

References
Specific Parasitic Infections
Protozoa

Cryptosporididiosis – Cryptosporidium hominis, C. parvum:
- Epidemiology: world wide
- Prevalence: 1-5% of diarrhoea in western countries (stool testing), 25% in developing countries using specific polymerase chain reaction (PCR)
- Risk factors: self limited in healthy men, of relevance in advanced HIV-infection
- Transmission/host: animal handlers, children, waterborne outbreaks
- Symptoms: watery diarrhoea is the most common clinical presentation
- Diagnosis: traditionally 3 stool samples, newer approaches: The ELISA kits for Cryptosporidium generally have performed well for the diagnosis of cryptosporidiosis with sensitivities ranging from 66% to 100% and excellent specificity
- Treatment: fluid replacement, loperamid (Imodium®), HAART

References
Specific Parasitic Infections
Protozoa

Microsporidiosis – Encephalolitozoon intestinalis, Enterocytozoon bieneusi:
- Epidemiology: worldwide opportunistic disease in HIV-infection
- Prevalence: 15-34% of patients with AIDS with chronic diarrhoea and no other identified causes
- Risk factors: poorly controlled HIV-infection, kidney transplant recipients, increasing among travelers and residents of tropical countries
- Transmission/host: still unclear, but thought to involve inhaling, or ingesting of spores
- Symptoms: chronic diarrhoea and wasting, in rare case involvement of the cornea (ocular microsporidiosis)
- Diagnosis: traditionally 3 stool samples to identify spores in faeces (specificity 95%), tissue samples for transmission electron microscopy (TEM) is the gold standard for identifying specific species, stool-PCR is also an option (specificity 98%)
- Treatment: intestinal disease: Metronidazole 500mg 2x/d for 14 days, disseminated disease: Albendazole 400mg 2x/d for 2-4 weeks

References
Specific Parasitic Infections
Protozoa

Cyclosporiasis – *Cyclospora cayetanensis*:
- Epidemiology: Latin America, Indian subcontinent, and Southeast Asia, opportunistic in HIV-infection
- Prevalence: e.g. in Vietnam 10% of water and food samples tested positive
- Risk factors: Travelers, poorly controlled HIV-infection
- Transmission/host: human to human (faecal-oral route)
- Symptoms: self limited diarrhoea, more severe in HIV-infection
- Diagnosis: traditionally 3 stool samples with Sheather`s floatation method (Sensitivity 93% in Egypt – prevalence in children 20%...)
- Treatment: Co-Trimoxazole 800/160mg 2x/d for 7 days in HIV consider prophylaxis with Co-Trimoxazole 800/160mg 3 times weekly

References
Specific Parasitic Infections
Protozoa

Isosporiasis – Isospora belli:
- Epidemiology: worldwide, especially in tropical and subtropical areas
- Prevalence: 0.32-3% in persons with AIDS, decreasing with Co-Trimoxazole prophylaxis for pneumocystis jiroveci pneumonia (PCP)
- Risk factors: immuno-compromised individuals (poorly controlled HIV)
- Transmission/host: Isospora belli infects both humans and animals, transmission: faecal-oral
- Symptoms: watery, nonbloody, offensive-smelling diarrhea, which may contain mucus, cramping abdominal pain, vomiting, weight loss, Low-grade fever
- Diagnosis: traditionally 3 stool samples (sensitivity: iodine staining microscopy 48%, fluorescence microscopy 96%), better performance: duodenal biopsies or Stool-PCR (specificity 100%)
- Treatment: Co-Trimoxazole 800/160mg 4x/d for 2-4 weeks in HIV consider prophylaxis with Co-Trimoxazole 800/160mg 3 times weekly

References
Specific Parasitic Infections
Protozoa

*Dientamoeba fragilis:*
- Epidemiology: worldwide, crowding and poor sanitation as a risk factor
- Prevalence: e.g. 0.9% in Australians
- Risk factors: travelers, military personnel
- Transmission/host: humans, pigs, gorillas, transmission by faecal-oral route
- Symptoms: important cause of travellers diarrhoea, chronic diarrhoea, fatigue, abdominal pain, fever, and in children, failure to thrive
- Diagnosis: traditionally 3 stool samples (sensitivity of 3 samples together is 70-85%), techniques include immunofluorescence and PCR
- Treatment: Metronidazole, 500–750mg 3x/d for 10 days

References
Specific Parasitic Infections
Protozoa

Balantidiasis – Balantidium coli:
- Epidemiology: worldwide, most common in Philippines
- Prevalence: over all, <1% is infected, in contrast: 28% in swine handlers/slaughterhouse workers in Papua New Guinea
- Risk factors: travelers and people who handle pigs
- Transmission/host: food/water (faecal-oral route), reservoirs pigs, rodents, primates
- Symptoms: either diarrhea or constipation (in acute disease, explosive diarrhea may occur), pneumonia by Balantidium coli is rare but possible
- Diagnosis: traditionally 3 stool samples (thought to large size and spiraling motility, balantidia can readily be recognized, trophozoites or cysts are often missed)
- Treatment: Metronidazole 750 mg 3x/d for 5 days or (described in a pulmonary affected patient) Doxycycline 100mg 1x/d for 3 weeks

References
Specific Parasitic Infections
Protozoa

Blastocystosis – Blastocystis hominis:
- Epidemiology: worldwide
- Prevalence: developed countries lesser then 10%, 3rd world up to 50%
- Risk factors: 3rd world residents, close contact to animals
- Transmission/host: human to human (faeco-oral route), reservoirs: pigs and dogs
- Symptoms: controversial, some studies report symptoms comparable to irritable bowel syndrome in 50-80%
- Diagnosis: traditionally 3 stool samples for Trichrome stain (sensitivity 95%, specificity 100%), PCR based diagnosis in studies
- Treatment: regime controversial, possible option: Metronidazole 500mg 3x/d for 10 days, or Co-Trimoxazole 800/160mg 3x/d for 10 days

References
Specific Parasitic Infections
Protozoa

Trypanosomiasis – South America [Chagas Disease]: Trypanosoma cruzi; Africa [sleeping sickness]: T. brucei gambiense or T. brucei rhodesiense:
- Epidemiology: Chagas disease (ChD) in South America, sleeping sickness (SIS) in tropical areas of Africa
- Prevalence: ChD 0.1% in Brazil to 24% in Bolivia (22% of them with cardiac, 3% with gastrointestinal or neurological involvement) [1], SIS: estimated overall prevalence in tropical Africa 0.5% focal villages in Democratic Republic of Congo, Angola, and southern Sudan, up to 50%.
- Risk factors: Endemic areas, travelers rare (ChD no US data for travelers as 0.1% are infected overall (mostly immigrants, few infections in southern US itself (e.g. Texas), SIS 1 case per year in US)
- Transmission/host: ChD: infected faeces of blood-sucking triatome bugs (‘kissing’ bugs), SIS: reservoirs human, cattles, antelopes, vector Tsetse fly
- Symptoms: ChD: two phases, acute phase lasts two months high number of parasites in blood allthought symptoms are absent or mild (fever, headache, enlarged lymph glands), chronic phase with destructive involvement of organs in 10-30%, SIS: first stage fever, headaches, joint pains, itching, lymphadenopathy, second stage with crossing blood-brain barrier (neurological phase) – changes of behaviour, confusion, sensory disturbances , and disturbance of the sleep cycle (which gives the disease its name) without treatment outcome fatal [2].
- Diagnosis: ChD serology for T. cruzi (important, as disease can be transmitted by blood donors [3]) SIS: serology only for T. brucei gambiensi (responsible for 95% of cases), gold standard: Lymph node aspiration with histopathological work-up
- Treatment (all agents not approved in human use in Switzerland): ChD: benznidazole or nifurtimox, SIS: 1st stage – Pentamidine (T.b. gambiense), or Suramin (T.b. rhodesiense), 2nd stage – Melarsoprol with considerable adverse effects due to arsenic component (T.b. gambiense, and rhodesiense), or Eflornithine with or without combination with nifurtimox (T.b. gambiense)

References
Specific Parasitic Infections
Helminthiases (Neomphalinae)

Anisakiasis – Anisakis simplex:
- Epidemiology: countries where raw fish is eaten (Scandinavia, Japan, Netherlands, and Pacific coast of South America)
- Prevalence: 90% of cases in Japan; incidence of bowel anisakiasis in Japan: 0.3/100’000 per year
- Risk factors: raw or undercooked seafood containing larvae
- Transmission/host: life cycle – crustaceans → fish → human
- Symptoms: Within hours after ingestion violent abdominal pain, nausea, and vomiting occur. Occasionally, the larvae pass into the bowel where they provoking a severe eosinophilic granulomatous response with symptoms mimicking Crohn’s disease (1-2 weeks following infection), additionally allergic reaction, including anaphylaxis is possible
- Diagnosis: definitive diagnosis is made by obtaining and visualizing worms through gastroscopy, at surgery, or in patient’s vomit
- Treatment: Often self limiting as human is a dead-end host. Sometimes small bowel obstruction needs surgical repair, if given early (i.e. before structural changes occur), treatment with Albendazole 400mg 2x/d for 21 days is indicated [1, 2]

References
Specific Parasitic Infections
Helminthes (Neomatodes)

Ankylostomiasis – Ancylostoma duodenale, Necator americanus:
- Epidemiology: A. duodenale abundant throughout the world, N. americanus North and South America
- Prevalence: i.e. 5% in nigerian school children (144/2’800)
- Risk factors: improper disposal of human faeces
- Transmission/host: contact of skin or oral contact with contaminated soil
- Symptoms: Light infection: abdominal pain, and loss of appetite. Heavy infection: protein deficiency, and iron deficiency anaemia by sucking blood from the host's intestinal walls (Ankylostomamiasis also includes cutaneous larva migrans [A. brasiliensis], and visceral larva migrans [Toxocara canis, T. cati])
- Diagnosis: Larvae cannot be found in stool specimen unless they are left at ambient temperature for a day or more
- Treatment: Albendazole 400mg once, or Mebendazole 100mg 2x/d for 3 days

References
Specific Parasitic Infections
Helminthes (Neommatodes)

Ascaris-Infection – Ascaris lumbricoides (length +/-30cm):
- Epidemiology: sub-tropical and tropical areas with poor sanitation
- Prevalence: most common helminth infection of humans worldwide (28% in a rural area of Canada [Nova Scotia], 45% in Latin America and 95% in parts of Africa
- Risk factors: travelers and imigrants from affected countries
- Transmission/host: infected vegetation or soil
- Symptoms: larvae migrate from the gut through the liver and lung – correspondingly: gastrointestinal discomfort, colic and vomiting, worms in stools (gut), gallstones, liver abscess, fever (liver), bloody sputum, vomiting worms, pulmonary eosinophilia (lung)
- Diagnosis: 1 stool samples with Kato-Katz technique (Sensitivity 97%)
- Treatment: Mebendazole 500mg as a single dose, or 100mg 2x/d fpr 3 days, alternatively Albendazole 400mg as a single dose

References
Specific Parasitic Infections
Helminthes (Neomatodes)

Capillariasis – *Capillaria philippinensis*, and *C. hepatica*:
- Epidemiology: *C. hepatica* worldwide; *C. philippinensis* Philippines/ Thailand
- Prevalence: *C. hepatica*: so far, 37 cases reported scattered around the world [1]; *C. philippinensis*: in the ‘high prevalence area’ Thailand, 82 cases were recorded over 12 years [2], in the Philippines (Northern Luzon) 1884 cases and 110 deaths were reported over 23 years [3], (in 2010 whole Luzon counted 48 millions of citizens)
- Risk factors: improper disposal of human or animal faeces (*C. hepatica*), fish as a host is mandatory for infection with *C. philippinensis*
- Transmission/host: animal hosts (carnivores for *C. hepatica*) → soil → human; fish (*C. philippinensis*) → ingested raw or undercooked
- Symptoms: *C. hepatica* initially asymptomatic, thereafter hepatitis with the triad of persistent fever, hepatomegaly and leucocytosis with eosinophilia (can be fulminant) [4]

*C. Philippinensis* leads to general abdominal pain and diarrhea, later on, nausea, vomiting, weight loss, and even death can occur.
- Diagnosis: *C. hepatica* by liver biopsy (stool samples can not be used for diagnosis); *C. philippinensis* by biopsy of small intestine or by analyzing stool samples
- Treatment: *C. hepatica*: Albendazole (10–20 mg/kg body weight/day) in combination with prednisolone (10 mg/d) for 20 days. *C. philippinensis*: Albendazole (400 mg 1x/d) for 30-days

References
Specific Parasitic Infections Helminthes (Neomatodes)

**Enterobiasis/Oxyuriasis – Enterobius vermicularis:**
- Epidemiology: worldwide, in the developed world it is the most common parasitic childhood infection
- Prevalence: Center of Disease Controll reports an incidence of 11.4% among people of all ages, in children it was 30%
- Risk factors: children below 18 years
- Transmission/host: human to human (faeco-oral route)
- Symptoms: itching in the anal area
- Diagnosis: routine stool examination gives a positive diagnosis in only 5-15%, perianal stick tape test can be of use (three consecutive nights detect 90% of infections); thought empiric approach also reasonable
- Treatment: Mebendazole 100mg at day 1 and 100mg at day 14

References
Specific Parasitic Infections
Helminthes (Neomatodes)

**Strongyloidiasis – Strongyloides stercoralis, S. fülleborni:**
- Epidemiology: worldwide, but mainly tropical and subtropical countries
- Prevalence: 30–100 million people worldwide
- Risk factors: travelers to and citizens of endemic areas
- Transmission/host: contact with contaminated soil (infection through skin lesions)
- Symptoms: principally skin symptoms (urticarial rashes), abdominal pain, diarrhoea, and weight loss (sometimes Loeffler's syndrome – pulmonary eosinophilia – occurs when larvae migrate through the lungs); in immuno-compromised patients infection can lead to hyperinfection syndrome which leads to death, if untreated (abdominal pain and distension, shock, pulmonary and neurologic complications as well as septicemia)
- Diagnosis: blood eosinophilia, stool is negative in up to 70% of tests, duodenal biopsy more appropriate, Cultures are most sensitive (not routinely available in the West)
- Treatment: First line therapy: Ivermectin 200 µg/kg body weight 1x/d for 1-2 days (not routinely available in Switzerland, but mandatory in hyperinfection syndrome – same dosage, given until repeated test results are negative for 2 weeks), alternative Albendazole, 400mg orally two times a day for 7 days

References
http://www.cdc.gov/parasites/strongyloides/health_professionals/
Specific Parasitic Infections
Helminthes (Neomatodes)

**Trichuriasis – Trichuris trichuria:**
- Epidemiology: areas with tropical weather and poor sanitation practices
- Prevalence: Trichuriasis infection prevalence is 50 to 80 percent in some regions of Asia (noted especially in China and Korea) – 600-800 millions worldwide
- Risk factors: travelers to, and citizens of endemic areas (especially children)
- Transmission/host: Humans are the main reservoir, transmission by contact with hands or food contaminated with egg-carrying soil
- Symptoms: infection primarily in the tissue of the cecum, appendix, colon and rectum → often asymptomatic, less common: abdominal pain and distention, bloody or mucus-filled diarrhea, and tenesmus combined with growth retardation in children
- Diagnosis: one stool sample with Kato-Katz technique (sensitivity 91%) [1]
- Treatment: Albendazole 400mg 1x/d for 3 days, or Mebendazole 100mg 2x/d for 3 days

References
Specific Parasitic Infections
Helminthes (Trematodes)

Echinostomiasis – Echinostoma ssp.:
- Epidemiology: southeast Asia and the Far East, mainly in cosmopolitan areas
- Prevalence: Indonesia average prevalence of 1% (Carney, 1991) up to 50% positive stool samples collected in Northern Thailand
- Risk factors: ingestion of one of several possible intermediate hosts
- Transmission/host: snails or other mollusks, some freshwater fish, crustaceans or amphibians
- Symptoms: usually asymptomatic, less common anemia, headache, gastric pain, loose stools, or heavy infections with abdominal pain, emaciation, weakness, anemia, profuse watery diarrhea, hemorrhage, edema, and anorexia
- Diagnosis: stool samples, no reliable data for test characteristics available
- Treatment: Praziquantel at 25 mg/kg body weight 3x/d for 1 day (not routinely available in Switzerland)

References
Specific Parasitic Infections
Helminthes (Trematodes)

Fasciolopsiasis – Fasciolopsis buski:
- Epidemiology: Southeast Asia (south-India to South east China)
- Prevalence: high prevalence-areas up to 1 out of 5 (Thailand) [1]
- Risk factors: ingestion (also accidently while swimming) of infected plants
- Transmission/host: amphibic snails → water plants → ingestion by human
- Symptoms: Mostly asymptomatic, less common severe infections with abdominal pain, chronic diarrhoea, anemia, ascites, and septicemia; allergic responses possible
- Diagnosis: systemic eosinophilia, stool samples (no sensitivity data available, although detection rate estimated to be high, discrimination of the eggs from other parasites eggs seems to be difficult/impossible)
- Treatment: Praziquantel 25mg/kg body weight 3x/d for 1-2 days

References
Specific Parasitic Infections
Helminthes (Trematodes)

Heterophyasis – Heterophyes heterophyes:
- Epidemiology: Egypt, Israel, Russia, Japan, South-East Asia
- Prevalence: 10 million infected individuals in the endemic areas of Asia
- Risk factors: eating raw fish
- Transmission/host: water snail → fish → host (human/animal) → defecation into water → snail...
- Symptoms: heavy infections (common) with intestinal pain, mucosal defects with diarrhoea – sometimes systemic spread is seen (heart, brain, spinal cord)
- Diagnosis: stool samples (no sensitivity data available)
- Treatment: Praziquantel 25mg/kg body weight 3x/d for 1 day

References
http://www.cdc.gov/parasites/fasciolopsis/health_professionals/index.html
Specific Parasitic Infections Helminthes (Trematodes)

Schistosomiasis/Bilharziosis – Schistosoma mansoni, S. japonicum, S. menkongi:
- Epidemiology: mainly Africa (see picture)
- Prevalence: Mali, Angola with more than 500 cases per 100’000 citizens
- Risk factors: poor sanitation with drinking contaminated water (e.g. during swimming in contaminated water)
- Transmission/host: mammalians → freshwater snails → infected water
- Symptoms: penetration of the human skin, haematologic spread, subsequent migration to the liver (cholestasis and fibrosis along the biliary ducts), and subsequently other organs: bladder (haematuria, cancer), mesenteric veins (abdominal pain, diarrhoea, and blood in the stool), kidney. Parasites and eggs themselves do not damage the body, rather immune response (granulomatous infection) causes the pathology
- Diagnosis: parasite eggs in stool (sensitivity 100% with more than 1 egg per gram of stool, lower egg-counts with poor sensitivity) or urine, serologic tests
- Treatment: Praziquantel 20mg/kg body weight 2-3x/d for one day (n/a for human use in Switzerland)
- Appendix: Egypt mass treatment in 80ies with tartar emetic (former drug used to treat Schistosomiasis, unfortunately needles were used repeatedly, Egypt hast the highest hepatitis C burden, HCV closely tracks the timing and intensity of the anti-schistosomiasis campaign...

References
http://www.who.int/mediacentre/factsheets/fs115/en/
http://www.cdc.gov/parasites/schistosomiasis/health_professionals/
Specific Parasitic Infections
Helminthes (Trematodes)

Fasciolosis – Fasciola hepatica, F. gigantica:
- Epidemiology: In Europe, the Americas and Oceania only F. hepatica, in many areas of Africa and Asia both species overlap
- Prevalence: rural Peru 15%, urban Peru 3.5%, 0.002% Normandie (France)
- Risk factors: Travelers, poorly controlled HIV-infection
- Transmission/host: Sheep, goats, cattles (reservoirs), freshwater snails (hosts) transmission by water plants (e.g. Nasturium officiale = common watercress)
- Symptoms: high fever and abdominal pain when flukes penetrating the intestinal tract and migrate to organs with strong predilection for liver tissue, i.e. biliary system, resulting in biliary obstruction (typical radiological findings are cystic lesion in the periphery of the liver)
- Diagnosis: stool (very low sensitivity), serological testing FAST-ELISA (sensitivity 95%)
- Treatment: oral bithionol at 30 mg/kg body weight for 5-10 days, or oral Triclabendazole 1-2 doses at 10 mg/kg body weight within a 24hour period

References
Behar et al.: Hepatic fascioliasis at a London hospital — the importance of recognising typical radiological features to avoid a delay in diagnosis. Brit J Radiol 2009;82:e189-e193
Specific Parasitic Infections
Helminthes (Trematodes)

Chinese liver fluke – Clonorchis sinensis:
- Epidemiology:
- Prevalence:
- Risk factors:
- Transmission/host:
- Symptoms:
- Diagnosis:
- Treatment:
Specific Parasitic Infections
Helminthes (Trematodes)

Cat liver fluke – Opistorchis felineus:
- Epidemiology:
- Prevalence:
- Risk factors:
- Transmission/host:
- Symptoms:
- Diagnosis:
- Treatment:

References
Specific Parasitic Infections

Helminthes (Trematodes)

South east asian liver fluke – Opistorchis viverrini:
- Epidemiology:
- Prevalence:
- Risk factors:
- Transmission/host:
- Symptoms:
- Diagnosis:
- Treatment:

References
Specific Parasitic Infections
Helminthes (Cestodes)

Taeniasis/Cysticercosis – Taenia solium (Cysticercosis), T. sanguinata:
- Epidemiology: T. solium (pork) T. sanguinata (cattles)
- Prevalence: taeniasis 10% in rural endemic areas (by serology), in western Europe:
  INCIDENCE of taeniasis 0.1-0.5%, PREVALENCE of cysticercosis 0.1-0.5%
- Risk factors: eating undercooked beef of infected pigs/cattles
- Transmission/host: hosts are pigs and cattles
- Symptoms: taeniasis: asymptomatic or irritable bowel-like symptoms, cysticercosis:
  cysts containing ovas (Cysticerci) can develop in muscles, eyes (ocular muscles, globe, conjunctiva),
  brain/spinal cord (neurocysticercosis)
- Diagnosis: traditionally 3 stool samples (poor sensitivity), enzyme-linked immunoblot assay
  (sensitivity 98%, specificity of 100%)
- Treatment: taeniasis: Praziquantel at 5-10 mg/kg body weight as single dose, invasive
cysticercosis: albendazole at 15 mg/kg body weight for 8 days with simultaneous steroids,
or praziquantel at 50 mg/kg body weight for 15 days

References
Specific Parasitic Infections
Helminthes (Cestodes)

Diphyllobothriasis – Diphyllobothrium latum:
- Epidemiology: parts of Europe, former UDSSR, North America, Asia, Uganda, Peru (because of Ceviche), Chile, and Japan
- Prevalence: e.g. 0.5% Brazil citizens who stated to eat raw fish tested positive, also while whole Brazil reported 1 case 1998 to 2003 → due to sushi consumption the number raised to 18 cases in 2004) [1]
- Risk factors: consumption of raw or undercooked freshwater fish
- Transmission/host: mammalian host → crusteans → fish → human
- Symptoms: infection can last for decades if untreated, mostly asymptomatic (80%); else, manifestations include abdominal discomfort, diarrhea, vomiting, weight loss, and Vitamin B12 deficiency; cholecystitis and Cholangitis as a rare complication
- Diagnosis: stool samples identify the numerous eggs usually present, thought difficult to identify eggs to species level (formaly low specific, but clinically not that important due to same treatment)
- Treatment: single dose of Praziquantel 10mg/kg body weight

References
Sampaio et al.: Diphyllobothriasis, Brazil. Emerg Inf Dis 2005;11:1598-1600
Specific Parasitic Infections
Helminthes (Cestodes)

Hymenolepsis nana:
- Epidemiology: most common in temperate zones
- Prevalence: e.g. 2% of Pakistani children <10 years tested positive
- Risk factors: children
- Transmission/host: faecal-oral route
- Symptoms: larva burrow into intestinal wall, in adults presentation can be asymptomatic or enteritis-like (abdominal pain, diarrhoea, loss of appetite, anal pruritus, rarely seizures are observed), in children the tapeworm can become a essential problem by absorbing ingested nutrition; allergic responses are also possible
- Diagnosis: repeated 3 stool samples (sensitivity 95.6% to 58.8%, depending on the stool preparation used [1])
- Treatment: single-dose Praziquantel, 25mg/kg body weight [2]

References
Specific Parasitic Infections
Helminthes (Cestodes)

Cystic/unilocular echinococcosis – Echinococcus granulosus:
- Epidemiology: present virtually worldwide, rural areas where dogs are able to ingest organs from infected animals
- Prevalence: e.g. incidence in the 80ies in South Wales (UK) was 4/100’000 per year
- Risk factors: ingestion of contaminated food/soil
- Transmission/host: Sheeps, (domestic) animals → dogs → contaminated soil/food
- Symptoms: cysts, 1126 asymptomatic individuals: 71 (90.1%) in liver and seven (9.9%) in lung [1], asymptomatic liver hydatid patients symptom-free for years, complicated courses by superinfection, rupture, or by compression of other structures by the cysts [2], after cyst ruptures, allergic reactions are possible
- Diagnosis: Imaging techniques (calcifications not always present), ELISA, confirmation by immunoblot
- Treatment: simple cystic echinococcosis surgical removal combined with Albendazole 400mg 2x/d for 1–5 months (prior or after surgery), Chemotherapy alone cures about 30% of patients (12 mo of follow-up) [2]

References
Specific Parasitic Infections
Helminthes (Cestodes)

Alveolar echinococcosis – Echinococcus multilocularis:
- Epidemiology: Northern hemisphere, including central Europe and the northern parts of Europe, Asia, and North America
- Prevalence: e.g. in Switzerland 10-20 new cases per year (8 million citizens)
- Risk factors: ingestion of contaminated food/soil
- Transmission/host: small rodents → foxes (dogs, cats) → contaminated soil/food
- Symptoms: multiple cysts growing in number, disseminating into other organs then the liver, mostly lungs and brain, but any organ involvement is possible
- Diagnosis: CT scans since CT scans are able to detect the largest number of lesions and calcifications that are characteristic of alveolar echinococcosis, ELISA, confirmation by immunoblot
- Treatment: if not resectable by surgery (consider Albendazole after surgery too), Albendazole 400mg 2x/d for at least 2 years, and follow-up for at least 10 years

References