Chapter 2

Infections of the Gastrointestinal Tract and Associated Structures

ANGULAR CHEILITIS

Agents: usually *Candida albicans*; also iron or riboflavin deficiency

Diagnosis: swab culture

Treatment: miconazole 2% gel or nystatin 100,000 U/g ointment topically to lesions 2-3 times daily for at least 2 w

MOUTH LESIONS

Agents: chickenpox, measles, molluscum contagiosum, human papillomavirus in 1.2% of HIV patients, *human human cytomegalovirus* in AIDS, *Lymphocryptovirus* (oral hairy leucoplakia in AIDS), enteroviruses, *Simplexvirus*, *Moraxella osloensis, Candida albicans* (pseudomembranous, erythematous, hyperplastic)

Diagnosis: viral culture and cytology of swab of lesions; serology; bacterial and fungal culture

Treatment:

Human Papillomavirus: surgical removal of lesion and surrounding tissue

***Human human cytomegalovirus*:** valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2-3 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly for 2-3 w then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria $\leq$ 2+ and creatinine clearance $\geq$ 55 mL/min) then as above every 2 w

Hairy Leukoplakia: high dose aciclovir

***Simplexvirus*:**

Herpes labialis: penciclovir cream

Internal Lesions: see **ACUTE HERPETIC GINGIVOSTOMATITIS**

Candida albicans:

Pseudomembranous and Erythematous: miconazole 2% gel (< 1 y: 1.25 mL; > 1 y: 2.5 mL) orally 6 hourly for 7-14 d, amphotericin 10 mg lozenge orally 6 hourly for 7-14 d (remove dentures while sucking if worn), nystatin suspension 100 000 units/mL 1 mL orally 6 hourly for 7-14 d; soak dentures in 1:100 sodium hypochlorite solution at night

Hyperplastic: fluconazole 3 mg/kg to 50-100 mg orally daily for 10-14 d, ketoconazole 5 mg/kg to 200 mg orally daily for 10-14 d

Others: non-specific

MOUTH ULCERS

Agents: many aphthous (cause unknown; may be linked to nutritional or physiological factors or hypersensitivity to oral streptococci); syphilis, necrotising ulcerative gingivostomatitis, *Mycobacterium tuberculosis*, *Simonsiella,* viruses especially coxsackievirus and *Simplexvirus*; also occurs in Reiter syndrome, Crohn's disease and ulcerative colitis and as a response to radiation and some drugs

Diagnosis: dark ground illumination, Gram stain or simple stain, viral and mycobacterial culture of tissue fluid and swab of lesions; direct immunofluorescence for herpes; serology; skin testing with autogenous streptococcal vaccine

Treatment:

Aphthous: saline rinse after each meal and at bedtime; chlorhexidine 0.2% mouthwash 10 mL 8 hourly, held in mouth 1 min; triamcinolone acetonide 0.1% paste topically 8 hourly, betamethasone valerate 0.05% ointment

More Severe: betamethasone dipropianate 0.05% ointment or cream

Major Ulceration: prednisolone or prednisone 20 mg orally daily for 5 d

AIDS: thalidomide 200 mg daily for 4 w

Syphilis, *Simonsiella*: penicillin

Tuberculosis: isoniazid 10 mg/kg to 300 mg orally once daily or 15 mg/kg to 600 mg orally 3 times weekly for 6 mo [+ pyridoxine 25 mg (breastfed baby 5 mg) orally with each dose] + rifampicin 10 mg/kg to 600 mg orally once daily 1 h before breakfast or 15 mg/kg to 600 mg orally 3 times a week for 6 mo + pyrazinamide 25-35 mg/kg to 2 g orally once daily or 50 mg/kg to 3 g orally 3 times weekly for 2 mo (6 mo if not known to be susceptible to isoniazid and rifampicin) + ethambutol 15 mg/kg orally daily (not

< 6 y or plasma creatinine > 160 μM/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isonazid and rifampicin (to 6 mo)

Severe Herpes: famciclovir 125 mg orally 12 hourly for 5 d, valaciclovir 500 mg orally 12 hourly for 5 d, aciclovir 5 mg/kg to 200 mg orally 5 times daily for 5 d; if unable to swallow, aciclovir 5 mg/kg i.v. 8 hourly for 5 d

Others: salt + sodium bicarbonate mouthwashes

MOUTH ABSCESS

Agents: *Rothia dentocariosa, Streptococcus milleri*

Diagnosis: culture of swab

Treatment: penicillin

NECROTISING ULCERATIVE GINGIVOSTOMATITIS (ACUTE INFECTIOUS GINGIVOSTOMATITIS, FETID STOMATITIS, FUSOSPIROCHAETAL STOMATITIS, PLANT ULCER, PLANT-VINCENT DISEASE, PLANT-VINCENT STOMATITIS, PUTRID SORE MOUTH, PUTRID STOMATITIS, SPIROCHAETAL STOMATITIS, STOMATITIS ULCEROMEMBRANACEA, STOMATITIS ULCEROSA, TRENCH MOUTH, ULCERATIVE STOMATITIS, ULCEROMEMBRANOUS STOMATITIS, VINCENT DISEASE, VINCENT INFECTION, VINCENT STOMATITIS): acute ulcerative necrotising condition of gum margins and other parts of mouth, often with pseudomembrane formation; may be restricted to gingival margins (necrotising ulcerative gingivitis, acute septic gingivitis, acute ulcerative gingivitis, acute ulceromembranous gingivitis, acute ulcerous gingivitis, fusobacillary gingivitis, fusospirillary gingivitis) or involve only parts of mouth other than gums (necrotising ulcerative stomatitis); rarely, may progress and become gangrenous (cancrum oris, fusospirochaetal gangrene, noma, stomatitis gangrenosa)

Agents: probably a mixed infection with *Leptotrichia buccalis, Treponema vincentii* and possibly other *Treponema*

Diagnosis: simple stain of swab

Treatment: local debridement; metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5 d + povidone iodine mouthwash diluted as directed 10 mL rinsed in mouth for at least 15 s 6 hourly or chlorhexidine 0.2% mouthwash 10 mL rinsed in mouth for 1 min 8-12 hourly or 0.12% mouthwash 15 mL rinsed in mouth 1 min 8-12 hourly

More Severe Or Unresponsive: metronidazole 10 mg/kg to 400 mg orally 12 hourly + phenoxymethylpenicillin 10 mg/kg to 500 mg orally 6 hourly or amoxycillin 10 mg/kg to 500 mg orally 8 hourly or (penicillin hypersensitive) clindamycin 7.5 mg/kg to 300 mg orally 8 hourly for 5 d

GEOGRAPHIC TONGUE, HAIRY TONGUE, BLACK HAIRY TONGUE

Agents: successive stages of papillary hypertrophy due to toxic effects of a number of agents; black colour due to overgrowth of anaerobes; often confused with fungal infection in later stages

Diagnosis: appearance

Treatment: avoidance of precipitating factors if known; salt and sodium bicarbonate mouthwashes

LINGUAL CELLULITIS: extremely rare; following minor local trauma in neutropenics

Agents: anaerobic streptococci, *Pseudomonas aeruginosa*

Diagnosis: blood cultures

Treatment: ticarcillin-clavulanate

ACUTE HERPETIC GINGIVOSTOMATITIS

Agent: *Simplexvirus*

Diagnosis: viral culture of swab of lesions, throat swab or washing in tissue culture; cytology and immunofluorescence or electron microscopy of scraping from base of vesicle if accessible

Treatment: famciclovir 500 mg orally 12 hourly for 7-10 d, valaciclovir 500 mg orally 12 hourly for 7-10 d, aciclovir 200 mg orally 5 times daily for 7-10 d

Frequent, Severe Recurrences: famiclovir 500 mg orally 12 hourly, valaciclovir 500 mg orally 12 hourly, aciclovir 200 mg orally 8 hourly or 400 mg orally 12 hourly

GINGIVITIS, PERIODONTITIS

Agents: commonest non-contagious disease; *Porphyromonas gingivalis* (dominant organism in rapidly progressive periodontitis), *Actinobacillus actinomycetemcomitans* (dominant organism in juvenile periodontitis), mixed anaerobes (fusospirochaetal; dominant organisms in adult periodontitis), *Porphyromonas asaccharolytica, Prevotella intermedius, Prevotella melaninogenica*, *Capnocytophaga*, *Campylobacter concisus, Treponema denticola, Bacteroides forsythus*; HIV (linear gingival erythema, which may lead to necrotising ulcerative periodontitis and/or stomatitis); also due to cyclosporin, phenytoin, calcium channel antagonists

Diagnosis: Gram or simple stain, anaerobic culture and culture in increased CO_2 of swab

Treatment: local dental care to control bacterial plaque; povidone iodine irrigation; debridement if necrosis; chlorhexidine 0.2% mouthwash 10 mL rinsed in mouth for 1 min 8-12 hourly or 0.12% mouthwash 15 mL rinsed in mouth for 1 min 8-12 hourly

Linear Gingival Erythema: professional removal of plaques and daily rinses with chlorhexidine gluconate

Pericoronitis, Root Canal Infection

Agents: mixed normal mouth flora

Diagnosis: clinical; culture usually not helpful

Treatment: local dental care in absence of tooth abscess; vigorous warm mouth rinses with saline or chlorhexidine 0.2%; topical povidone iodine

Tooth Abscess

Agents: mixed oral flora

Diagnosis: culture of aspirated pus

Treatment: removal of infected pulp tissue ± drainage; if systemic signs and symptoms, phenoxymethylpenicillin 10 mg/kg to 500 mg orally 6 hourly or amoxycillin 10 mg/kg to 500 mg orally 8 hourly for 5 d; if more severe or unresponsive, + metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5 d or amoxycillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally 12 hourly for 5 d alone

Penicillin Hypersensitive: clindamycin 7.5 mg/kg to 300 mg orally 8 hourly for 5 d

Other Dental Infections

Agents: various anaerobes

Diagnosis: culture of deep aspiration or surgical specimen

Treatment: penicillin, clindamycin, chloramphenicol

Salivary Calculi

Agent: *Actinomyces*

Diagnosis: anaerobic culture

Treatment: removal; penicillin if necessary

Parotitis and Submandibular Sialadenitis

Agents: mumps virus (epidemic parotitis), coxsackievirus, parainfluenza 1 and 3, lymphocytic choriomeningitis virus, influenza A, *Staphylococcus aureus* (nosocomial and xerostomia-inducing process), streptococci, anaerobes, enteric Gram negative bacilli, *Mycobacterium tuberculosis*, *Actinomyces*, *Actinobacillus actinomycetemcomitans* (uncommon), *Burkholderia pseudomallei*, *Pseudomonas aeruginosa,* also in 4% of Rocky Mountain spotted fever cases; also neoplastic, cysts, drugs (iodides, bromides, phenothiazines, propylthiouracil, isoproteneol), obstruction, malnutrition, gout, uremia, sarcoidosis, Mikulicz's disease, Sjorgren's syndrome, cystic fibrosis; may be confused with lymphadenopathy, masseter hypertrophy, dental abscess

Diagnosis: pain, swelling, dysphagia, tense swelling over parotid area, tenderness, pain on opening mouth; viral culture of saliva, throat swab, urine; serology (complement fixation test, haemagglutination inhibition); increased serum amylase; bacterial culture of purulent discharge from Stensen's duct or surgical drainage material

Treatment: early surgical drainage may be necessary in suppurative sialadenitis

Viral: none

Staphylococcus aureus: di(flu)cloxacillin 50 mg/kg to 2 g i.v. 6 hourly then 12.5 mg/kg to 500 mg orally 6 hourly for total 10 d, clindamycin 10 mg/kg to 450 mg i.v. 8 hourly then 10 mg/kg to 450 mg orally 8 hourly for total 10 d, lincomycin 15 mg/kg to 600 mg i.v. 8 hourly then clindamycin 10 mg/kg to 450 mg orally 8 hourly for total 10 d

Mycobacterium tuberculosis: isoniazid 10 mg/kg to 300 mg orally once daily or 15 mg/kg to 600 mg orally 3 times weekly for 6 mo [+ pyridoxine 25 mg (breastfed baby 5 mg) orally with each dose] + rifampicin 10 mg/kg to 600 mg orally once daily 1 h before breakfast or 15 mg/kg to 600 mg orally 3 times a week for 6 mo + pyrazinamide 25-35 mg/kg to 2 g orally once daily or 50 mg/kg to 3 g orally 3 times weekly for 2 mo (6 mo if not known to be susceptible to isoniazid and rifampicin) + ethambutol 15 mg/kg orally daily (not < 6 y or plasma creatinine > 160 μM/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isonazid and rifampicin (to 6 mo)

Burkholderia pseudomallei: early surgical drainage + cotrimoxazole + ceftazidime or meropenem or imipenem

Other Bacteria: cloxacillin + aminoglycoside + clindamycin or penicillin if anaerobes isolated or suspected; rehydration

GASTROINTESTINAL TRACT INFECTIONS: Even under the best of conditions, a specific agent is not found in the majority of cases of gastrointestinal tract disturbances. This may be due to a number of factors: infection due to an uncommon and unlooked-for organism or to an organism not yet implicated in gastrointestinal tract infection; deficiencies in transport and/or isolation procedures for some organisms; the sporadic nature of the presence of some organisms in faeces; the existence of a dietary or physiological (eg., lactase deficiency, gluten sensitivity, Crohn's disease, etc) cause unrelated to infection

OESOPHAGITIS: mainly in immunocompromised patients; 0.1% of ambulatory care visits in USA

Agents: *Mycobacterium tuberculosis*, *Candida*, *Simplexvirus*, enteroviruses, *human human cytomegalovirus*; also non-infectious ulcers in AIDS

Diagnosis: dysphagia, odynophagia, retrosternal pain; esophagoscopy; barium swallow; KOH smear, viral culture and monoclonal antibody immunofluorescence to *Simplexvirus* and *human cytomegalovirus* on esophageal brushings; hematoxylin and eosin stain, Grocott methenamine silver stain, Ziehl-Neelsen stain, monoclonal antibody immunofluorescence to *Simplexvirus*, *human cytomegalovirus*, mycobacterial culture, fungal culture and viral culture on esophageal biopsy specimens

Tuberculosis: positive tuberculin test, mediastinal adenopathy

***Candida*:** recent onset of retrosternal pain on swallowing + oral candidiasis diagnosed by gross appearance of white patches or plaques on an erythematous base or by the microscopic appearance of fungal mycelial filaments from a specimen cultured from oral mucosa

Treatment:

***Mycobacterium tuberculosis*:** isoniazid 10 mg/kg to 300 mg orally once daily or 15 mg/kg to 600 mg orally 3 times weekly for 6 mo [+ pyridoxine 25 mg (breastfed baby 5 mg) orally with each dose] + rifampicin 10 mg/kg to 600 mg orally once daily 1 h before breakfast or 15 mg/kg to 600 mg orally 3 times a week for 6 mo + pyrazinamide 25-35 mg/kg to 2 g orally once daily or 50 mg/kg to 3 g orally 3 times weekly for 2 mo (6 mo if not known to be susceptible to isoniazid and rifampicin) + ethambutol 15 mg/kg orally daily (not < 6 y or plasma creatinine > 160 µM/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isonazid and rifampicin (to 6 mo)

***Candida*:** fluconazole 5 mg/kg to 200 mg orally initially then 2.5 mg/kg to 100 mg daily for 14 d or itraconazole 200 mg capsule orally daily or 100 mg (10 mL) oral suspension twice daily for 14 d; if resistant, voriconazole 200 mg orally 12 hourly for 14 d or amphotericin B desoxycholate 0.5 mg/kg i.v. daily for 14 d

Repeated Episodes in HIV Infection: fluconazole 100 mg orally daily, itraconazole 200 mg orally daily, ketoconazole 200 mg orally daily

***Simplexvirus*:** as for **HERPETIC GINGIVOSTOMATITIS**

***Human cytomegalovirus*:** valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2-3 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly or 180 mg/kg/d by continuous i.v. infusion for 14 d then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria ≤ 2+ and creatinine clearance ≥ 55 mL/min) then as above every 2 w

Non-infectious: prednisone

GASTRITIS, DUODENAL ULCER, PEPTIC ULCER, DYSPEPSIA: 0.5% of ambulatory care visits in USA

Agents:

Simple Gastritis, Duodenal Ulcer, Peptic Ulcer, Dyspepsia: *Helicobacter pylori;* peptic ulcer also due to NSAID ingestion; also gastritis and antral obstruction due to *human cytomegalovirus* in AIDS and posttransplantation

Emphysematous Gastritis: 22% *Escherichia coli*, 22% streptococci, 19% *Enterobacter,* 11% *Pseudomonas aeruginosa*, others; mortality 61%, gastric constrictions 21%

Diagnosis:

***Helicobacter pylori*:** silver or Gram stain, phase contrast microscopy and culture of multiple gastric mucosal biopsies on chocolate agar or brain heart infusion agar with and without nalidixic acid (50 mg/L), vancomycin (3 mg/L) and trimethoprim (5 mg/L) (histology sensitivity 88-95%, specificity 90-95%, very readily available, very expensive; culture 80-90% sensitivity, 95-100% specificity, less readily available, expensive); ^{13}C urea breath test (sensitivity 90-95%, specificity 90-95%, very readily available, expensive); ^{14}C urea breath test (sensitivity 86-95%, specificity 86-95%, readily available, less expensive; give drink containing 4 g citric acid before test if taking proton pump inhibitor), antigen in stool test (sensitivity 88-100%, specificity 70-96%, less readily available, less expensive); Stat Simple fingerstick antibody test (sensitivity 60-90%, specificity 70-85%, very readily available, relatively inexpensive); ELISA (sensitivity 80-95%, specificity 80-95%, readily available, inexpensive); rapid urease test (sensitivity 90-95%, specificity 90-95%, very readily available,

relatively inexpensive); Leukostix rapid leucocyte strip test (sensitivity 98%, specificity 77%); barium study; testing should not be done less than 4 w after cessation of antibiotics or bismuth compounds or 1-2 w after proton pump inhibitors; serological tests for antibodies are unsuitable for post-treatment testing because antibody titres may take months to fall

***Human cytomegalovirus*:** endoscopy with biopsy; PCR on blood

Emphysematous Gastritis: 37% ingestion of corrosive substances, 22% alcohol abuse; acute abdomen with systemic toxicity; X-rays show gas bubbles within stomach wall; computed tomography; culture of gastric aspirate

Treatment:

***Helicobacter pylori*:** omeprazole 20 mg orally 12 hourly or lansoprazole 30 mg orally 12 hourly for 7 d + clarithromycin 500 mg orally twice daily for 7 d + amoxycillin 1 g orally twice daily for 7 d or metronidazole 400 mg orally 3 times daily for 1 w

Treatment Failure: colloidal bismuth subcitrate 1 tablet (107.7 mg) chewed and swallowed 4 times daily for 2 w + tetracycline 500 mg 6 hourly for 2 w + metronidazole 200 mg orally 3 times daily and 400 mg orally at night for 2 w + omeprazole 20 mg or lansoprazole 30 mg or pantoprazole 40 mg twice daily for 14 d; rifabutin 300 mg 4 times/d + pantoprazole 40 mg twice a day + amoxycillin 1 g twice a day

***Human cytomegalovirus*:** valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2-3 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly for 2-3 w then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria $\leq$ 2+ and creatinine clearance $\geq$ 55 mL/min) then as above every 2 w

Emphysematous Gastritis: i.v. fluid, nutritional support; tobramycin + imipenem; surgery as required

Constipation is mainly due to dietary causes (including in infant metabolic alkalosis) but also occurs in 26% of cases of cryptosporidiosis (after initial diarrhoea in 22%), in 18% of brucellosis cases and 5% of cases of subdural empyema, and also in botulism, diphyllobothriasis, *Entamoeba histolytica* and *Salmonella typhi* infections and (alternating with diarrhoea) in strongyloidiasis

Bloody Stools occur in enterohemorrhagic *Escherichia coli* infections, amoebic dysentery, 60% of cases of shigellosis, 31% of acute schistosomiasis, 26% of *Campylobacter* enteritis, 21% of salmonellosis, 12% of enterotoxigenic *Escherichia coli* infections, 7% of typhoid fever, 4% of cholera, and also in necrotising enterocolitis and *Vibrio cholerae* non-01 infections; also in ulcerative colitis

Fatty Stools, when due to infectious causes, are usually due to *Giardia intestinalis*

Acute Diarrhoea and/or Vomiting: 4% of new episodes of illness in UK; 99 million episodes/y among adults in USA (with 8 million doctor visits and 1.5% of hospitalisations; 85% of deaths in > 60 y)

Agents: due to infectious causes in 90% of cases; developed areas: 10-27% *Norovirus*, 8-50% *Rotavirus*, < 5% enteropathogenic *Escherichia coli* (atypical strains), 3-7% *Giardia intestinalis,* 3-4% *Cryptosporidium,* 2-52% *Salmonella*, 2% enteric adenovirus (< 2 y), 1-40% *Campylobacter*, 1-16% enterotoxigenic *Escherichia coli,* 1-4% *Shigella*, 1-4% *Yersinia,* 0.6% *Entamoeba histolytica*, 0.2% *Strongyloides, Vibrio, Aeromonas, Clostridium difficile, Bacteroides fragilis;* developing areas: 7-50% enterotoxigenic *Escherichia coli*, 5-45% *Rotavirus*, 5-16% *Shigella*, 5-10% enteric adenovirus (< 4 y), 5% *Strongyloides*, 4-10% *Cryptosporidium*, 4-8% enteropathogenic *Escherichia coli* (typical strains), 2-15% *Entamoeba histolytica*, 2-14% *Campylobacter*, 1-44% *Giardia lamblia*, 1-6% *Yersinia*, 1-2% *Norovirus*, 0-15% *Salmonella*, *Vibrio*, *Aeromonas*, *Clostridium difficile*, *Bacteroides fragilis*; AIDS: *Cryptosporidium*, *Microsporidium, Isospora belli, Pneumocystis jiroveci, Strongyloides, Entamoeba histolytica, Giardia lamblia, human cytomegalovirus*, *Mycobacterium avium-intracellulare*, *Mycobacterium tuberculosis*, *Salmonella*, *Campylobacter*, AIDS 'enteropathy'; acute diarrhoea may also be due to cancer of the colon and rectum, non-infectious food poisoning or ulcerative colitis; acute vomiting may also be caused by preformed toxins (vomitoxin, *Staphylococcus aureus* toxin, *Bacillus cereus* toxin, heavy metals, nitrites, *Aminita* mushrooms), acute nephritis, anemia, diabetic precoma, glaucoma, migraine, myocardial infarction, pregnancy and renal colic

Diagnosis: feces examination (ulcerative colitis: 90% polymorphonuclears + $\approx$ 10% eosinophils); collapsed patient: electrolytes and hematocrit; other investigations only if not resolved within 48 h

Treatment: dietary restriction; oral fluids and i.v. fluids in dehydration; *Lactobacillus* $\geq 10^{10}$ cfu $\geq$ twice daily; specific treatment as indicated

Diarrhoea: global incidence 4 billion/y; global morbidity 3-5 billion/y; global mortality 3-4 M/y; 90% simple diarrhoea (mainly viral (agents of **Epidemic Viral Diarrhoea** and echovirus 8, 19, 20, 22-24, 32) in industrialised countries, also bacterial and protozoal in less developed), 5-10% dysentery (*Shigella*, *Campylobacter jejuni,* enteroinvasive *Escherichia coli*), 3-4% protracted diarrhoea ($\geq$ 14 d; enteropathogenic *Escherichia coli*, *Giardia lamblia*), 1% severe passing of rice water stools (*Salmonella* and enterotoxigenic *Escherichia coli* in industrialised countries, cholera and enteropathogenic *Escherichia*

coli in less developed); as well as in enteric infections, diarrhoea occurs as a symptom in 61% of measles cases occurring in malnourished (13% bloody), in 57% of cases of neonatal listeriosis, in 41% of cases of Kawasaki syndrome (days 1-14), in 40% of cases of primary sepsis and 12% of wound infections due to *Vibrio vulnificus*, in 33% of cases of cranial epidural abscess, 31% of brain abscess and 10% of subdural empyema due to *Salmonella*, in 33% of cases of Korean hemorrhagic fever, in 30% of peritonitis, in influenza A (in 27% of cases) and B (in 35% of infected school-age children, 10% of infected pre-school children, 4% of infected adults), in 21% of cases of *Yersinia pseudotuberculosis* infections, 19% of cases of amoebic liver abscess, 19% of Rocky Mountain spotted fever (9% in first 3 d), 16% of brucellosis cases, and in AIDS, congenital malaria, Crimean-Congo hemorrhagic fever (liquid), Ebola hemorrhagic fever, grain itch, Lassa fever, Lyme disease (mild, watery), Marburg virus disease, plague (massive), psittacosis, toxic shock syndrome (84% profuse, watery at onset), Reye syndrome; also in chemical poisoning, gastroenteritis-type mushrooms (*Amanita, Phalloidin, Gyromitrin* toxin group) ingestion, in protein-energy malnutrition (non-bloody), and due to antibiotics and other medications or to diet

Diagnosis: feces micro and culture; unexplained abdominal pain and fever persisting or suggesting an appendicitis-like syndrome suggests *Yersinia enterocolitica;* bloody diarrhoea, especially if without fecal leucocytes, suggests enterohemorrhagic (shiga toxin-producing) *Escherichia coli* or amoebiasis (where leucocytes are destroyed by the parasite); ingestion of inadequately cooked seafood should prompt consideration of *Vibrio* infections or *Norovirus*; cytotoxigenic *Clostridium difficile* should be considered in diarrhoea associated with antibiotic use; persistence > 10 d with weight loss should prompt consideration of giardiasis or cryptosporidiosis; travel to tropical areas or consumption of untreated water increases the chance of enterotoxigenic *Escherichia coli* as well as viral (eg., Norwalk-like or rotaviral), parasitic (eg., *Giardia intestinalis*, *Entamoeba histolytica*, *Strongyloides*, *Cryptosporidium, Cyclospora cayetanensis*) and, if faecal leucocytes are present, invasive bacterial pathogens (eg. *Shigella*, *Salmonella*, *Campylobacter*); outbreaks should prompt consideration of *Staphylococcus aureus*, *Bacillus cereus, Anisakis* (incubation period < 6 h), *Clostridium perfringens* (incubation period 12-18 h), enterotoxigenic *Escherichia coli* or *Vibrio* (noninflammatory), *Salmonella*, *Campylobacter*, *Shigella,* enteroinvasive *Escherichia coli* infection, enterohemorrhagic *Escherichia coli*, *Vibrio parahaemolyticus, Yersinia enterocolitica* and *Entamoeba histolytica* (inflammatory); short incubation period also suggests metal or monosodium glutamate poisoning; neurologic symptoms suggest botulism, fish poisoning (scombroid, ciguatera, tetrodon), shellfish poisoning (neurotoxic, paralytic, amnesic), mushroom poisoning, organophosphate pesticides, thallium poisoning, Guillain-Barré syndrome associated with *Campylobacter jejuni* diarrhoea; systemic illness suggests *Listeria monocytogenes, Brucella, Vibrio vulnificus, Trichinella spiralis, Toxoplasma gondii,* hepatitis A virus (0.8% of foodborne disease outbreaks in USA, 0.8% of cases, no deaths; incubation period 15-50 d; from shellfish, foods prepared by infected food handler); if unexplained, consider saving *Escherichia coli* for labile toxin, stable toxin, invasiveness, adherence testing and serotyping, and save stool for *Rotavirus*, and stool + paired sera for *Norovirus* testing; sigmoidoscopy in symptomatic homosexual males should distinguish proctitis in the distal 15 cm only (caused by *Simplexvirus*, gonococcal, chlamydial or syphilitic infection) from colitis (with *Campylobacter*, *Shigella*, *Clostridium difficile* or *Chlamydia* infections) or non-inflammatory diarrhoea (due to giardiasis); immunocompromised hosts should have a wide range of viral (eg., *human cytomegalovirus*, *Simplexvirus*, *coxsackievirus*, *Rotavirus*), bacterial (eg., *Salmonella*, *Mycobacterium avium-intracellulare*, *Listeria),* fungal (eg., *Candida*) and parasitic (eg., *Cryptosporidium*, *Strongyloides*, *Entamoeba histolytica* and *Giardia lamblia*) agents considered

Treatment: hydrate with oral replacement solution (child: fruit juice drinks or carbonated beverages diluted 1 in 4 with warm water) or i.v.; antibiotics should only be used for dysentery and suspected cholera; otherwise, they are ineffective and should not be given; antiparasitic drugs should only be used for amoebiasis (after antibiotic treatment of bloody diarrhoea for *Shigella* has failed or trophozoites of *Entamoeba histolytica* containing red blood cells seen in feces) and for giardiasis (when diarrhoea has lasted at least 14 d and cysts or trophozoites of *Giardia lamblia* are seen in feces or small bowel fluid); antidiarrhoeal drugs and antiemetics should never be used since none has proven practical value and some are dangerous

Epidemic Viral Diarrhoea: 80% of acute diarrhoea; incubation period 16-36 h; duration of illness 1-2 d

Agents: *Norovirus* (in 84% of infections; low infectious dose, prolonged asymptomatic shedding, environmental stability, substantial strain diversity, lack of lasting immunity; 4% of foodborne disease outbreaks in Australia; 23 M estimated cases/y in USA, 7% of foodborne related deaths, 0.3% of foodborne disease outbreaks, 1% of cases), *Rotavirus* A (mainly infants; > 9% of children worldwide infected by 3 y; causes ≈ 1/3 diarrhoea-associated hospitalisations (in Australia, ≈ 50% of those in children; rate from 9.2/1000 in Victoria to 50/1000 in Northern Territory) and 800,000 deaths/y; adult outbreaks in hospitals, nursing homes, isolated communities and travellers; 0.9% mortality), adenovirus (6% of hospitalised children with diarrhoea; 0.2% mortality in infants; types 40, 41 and others in AIDS; 15% of nosocomial), *Astrovirus* (7% of hospitalised children with diarrhoea), 3% parvovirus (in 47% of infections; 19% of water-borne outbreaks), *Sapovirus,* poliovirus 2 and 3, coxsackievirus (A, B3 probable etiologic agents), echovirus (probable

etiologic agent; 7, 9, 11 (in 23% of infections), 12 (in 100% of infections), 14 and 18), measles, parainfluenza (in 15% of cases), ? *Human torovirus*, ? *Human picobirnavirus*

Diagnosis: abrupt onset, diarrhoea, abdominal pain, vomiting common, fever uncommon, upper respiratory symptoms common, convulsions rare, anal sphincter laxness rare; stools loose, more or less malodorous, blood rare, colour variable, mucus absent; no leucocytes in feces; viral culture of feces; radioimmunoassay, ELISA (antigen and antibody), agglutinations, direct immunofluorescence, electron microscopy and immune electron microscopy (research method) of feces; hemagglutination inhibition antibody technique, neutralisation antibody titre

***Rotavirus*:** from fecally contaminated foods, ready to eat foods touched by infected food workers (salads, fruits); age 6 mo - 2 y, incubation period 1-3 d, diarrhoea ++++ (75% watery), vomiting in 85%, abdominal pain in 62%, low grade fever in 28%, myalgia, headache; duration of symptoms 3-5 d; at d3-d6, 2-3 mm pink-red macules on trunk, spreading to limbs and face; no leucocytes or erythrocytes in stool micro; antigen detection by enzyme immunoassay

***Norovirus*:** adults and school-aged children, incubation period 1-2 d, nausea in 90-97% of cases, watery vomiting ++++ in 85-97%, abdominal pain and cramps ++ in 80-86%, chills in 78%, muscle aches in 67%, fever + in 64-66%, headache in 61-70%, large volume diarrhoea in 58-84%, sore throat in 10%; duration of symptoms 12-60 h; shedding from patients up to 3 w; 72% of sourced infections from food (poorly cooked shellfish, raw seafood, ready to eat foods touched by infected food workers, salads, sandwiches, ice, cookies, fruit), 22% person-to-person and 6% waterborne; no leucocytes or erythrocytes in stool micro; electron microscopy and immune electron microscopy; > 4X increase in antibody titre (enzyme immunoassay); nucleic acid hybridisation assay and reverse transcriptase-polymerase chain reaction

***Sapporo virus*:** children < 5 y; 95% diarrhoea during first 5 d, 60% vomiting on first day; shedding up to 14 d; laboratory tests as for *Norovirus*

Other Viral Agents: from faecally contaminated foods or water, ready to eat foods touched by infected food workers, some shellfish; incubation period 10-70 h; nausea, vomiting, diarrhoea, malaise, abdominal pain, headache, fever; duration of illness 2-9 d; virus isolation, serology

Treatment: rehydration, restricted diet; dehydration requires hospitalisation and fluid replacement under biochemical control

***Norovirus*:** bismuth sulphate

***Rotavirus*:** severe diarrhoea may require fluid and electrolyte replacement; infants, children, elderly and immunocompromised especially vulnerable

Prophylaxis (*Rotavirus*): tetravalent rhesus-human reassortant *Rotavirus* vaccine (49-68% protection against diarrhoea, 61-100% against severe disease) no longer recommended because of substantial increase in intussusception; live oral pentavalent vaccine also possibly linked to intussesception; hyperimmune bovine colostrum containing anti-*Rotavirus* antibodies

HAKURI (ALIMENTARY TOXICOSIS, CHOLERA INFANTUM, PSEUDOCHOLERA INFANTUM, SAKAMOTO DISEASE)

Agent: ? *Rotavirus*

Diagnosis: vomiting and diarrhoea with whitish, watery stools; low grade fever in most cases, cough in some

Treatment: rehydration, restricted diet; dehydration requires hospitalisation and fluid replacement under biochemical control; oral human gamma globulin or bovine milk concentrate containing antibody to *Rotavirus*

INFANTILE DIARRHOEA

Agents: certain serotypes of *Escherichia coli*

Diagnosis: age 0-5 y, no diarrhoea in household, gradual onset, vomiting uncommon, fever absent, convulsions rare, anal sphincter normal; stools loose, slimy, foul odour, blood rare, colour green, mucus variable; laboratory tests to identify relevant strains are grossly inadequate; serotyping against the limited range of serotypes believed to be important enteropathogenic strains is the only method suitable for routine use; complement lysis is used in research

Treatment: ampicillin or aminoglycoside in systemic infection

TRAVELLER'S DIARRHOEA (ADEN GUT, AZTEC TWO STEP, BACKDOOR SPRINT, BASRA BELLY, CANARY DISEASE, CASABLANCA CRUD, COELIAC FLUX, DEHLI BELLY, GIS, GREEK GALLOP, GYPPIE TUMMY, HONG KONG DOG, LE TURISTA, MALTA DOG, MEXICAN CALL IT, MONTEZUMA'S REVENGE, PASSION, POONAH POOHS, RANGOON RUNS, SAN FRANCISCITIS, SUMMER COMPLAINT, TOURIST TROTS, TURKEY TROTS): mild cholera-like disease in adults; incidence 3-54%

Agents: 20-62% none identified, 8-75% enterotoxigenic strains of *Escherichia coli* (744-1000 million episodes with 4-6 M deaths annually in Africa, Latin America and Asia excluding China), 0.5-2% enteroinvasive *Escherichia coli*, 0-36% *Rotavirus*, 0-30% *Shigella* (17% of notified cases in Australia), 0-25% *Salmonella* (8% of *Salmonella* notifications in Australia), 0-15% enteroadherent *Escherichia coli*, 0-15% *Campylobacter jejuni*, 0-10% *Giardia lamblia*, 0-8% *Aeromonas*, 0-7% *Vibrio*

parahaemolyticus (diarrhoea in 95% of infections), 0-7% *Plesiomonas shigelloides,* 0-5% *Entamoeba histolytica*, 0-2% *Vibrio cholerae* non-01, 0-2% *Cryptosporidium*, 0-1% *Vibrio fluvialis,* 0-1% *Yersinia enterocolitica* (diarrhoea in 86% of infections), 0-1% enterohemorrhagic *Escherichia coli*, 0-0.3% *Vibrio cholerae* 01, *Vibrio vulnificus, Vibrio alginolyticus, Vibrio mimicus, Vibrio furnissii*

Diagnosis: 3-8 stools/d in 80% of cases; abdominal pain and cramps in most cases; fever, vomiting, bloody stools in 10-20%; typically lasts 3-5 d but > 1 w in 10%; micro for parasites, bacterial and viral culture of feces

Enterotoxigenic *Escherichia coli:* highest in summer; 99% diarrhoea, 79-82% abdominal pain and cramps, 49% nausea, 17-22% fever, 14-54% vomiting; from water or food contaminated with human feces; incubation period 1--3 d; duration of illness 3->7 d; 87% of cases 5-10 stools/d, 78% watery, 40% mucus, 12% blood, no leucocytes; test for toxin production in Chinese hamster ovary cells

Invasive *Escherichia coli* and Shigellosis: 78% of cases 5-10 stools/d, 60% blood, 70% mucus, 24% watery; 85% polymorphonuclears in feces

Salmonella: 75% of cases 5-10 stools/d, 50% mucus, 33% watery, 21% blood

***Campylobacter jejuni*:** highest in winter; diarrhoea in all cases; 82% explosive, watery; 66% > 10 stools/d; 26% with blood, 61% mucus; 8% persisting or recurring 2 w or more

***Aeromonas*:** 56% of cases 5-10 stools/d, 51% watery, 37% mucus, 15% blood, 33% guiac test positive, 50% diarrhoea 3-10 d, 50% > 10 d

***Cryptosporidium*:** from contaminated water, vegetables, fruits, unpasteurised milk, swimming pools; incubation period 2-28 d; diarrhoea in 84% of infections (5-10 watery, frothy bowel movements/d), cramping, abdominal pain, sometimes fever, vomiting; usually lasting 1-5 d in noncompromised and months in compromised

***Vibrio cholerae* 01:** bloody, watery

Vibrio vulnificus: vomiting, diarrhoea, abdominal pain, bacteremia, may be wound infections; more common in immunocompromised and patients with chronic liver disease (associated bullous skin lesions); incubation period 1-7 d; duration of illness 2-8 d; from undercooked or raw shellfish (especially oysters), other contaminated seafood (also open wounds exposed to sea water); stool cultures on thiosulphate citrate bile sucrose agar; wound and blood cultures if indicated

Vibrio parahaemolyticus: acute watery diarrhoea, abdominal cramps, nausea, vomiting; incubation period 2-48 h; from undercooked or raw seafood (especially shellfish); stool culture on thiosulphate citrate bile sucrose agar

Vibrio fluvialis: diarrhoea in 100% (75% bloody), vomiting in 97%, abdominal pain in 75%, dehydration in 67%, fever in 35%

Treatment:

Mild (1-2 Loose Stools/24h, Tolerable Symptoms): rehydration, dietary restriction

Moderate to Severe: azithromycin 20 mg/kg to 1 g orally as single dose or norfloxacin 20 mg/kg to 800 mg orally as single dose; if no improvement of if fever or bloody stools, azithromycin 10 mg/kg to 500 mg orally daily for 2-3 d or norfloxacin 10 mg/kg to 400 mg orally 12 hourly for 2-3 d or ciprofloxacin 10 mg/kg to 500 mg orally 12 hourly fo 2-3 d

Persistent (> 3 w) and No Clear Diagnosis: tinidazole 2 g orally with food as a single dose

Prophylaxis:

High Risk Host (Immunodeficiency Including AIDS, Insulin Dependent Diabetes Mellitus, Active Inflammatory Bowel Disease, Cardiac or Renal Failure, Use of Potent H_2-receptor Antagonists or Omeprazole): norfloxacin 10 mg/kg to 400 mg orally daily or ciprofloxacin 10 mg/kg to 500 mg orally daily for not more than 3 w

Purpose of Trip Would be Ruined by Illness: colloidal bismuth subcitrate 2 tablets chewed with meals and at bedtime to 8 tablets/d for not more than 3 w

consumption of beverages ready bottled or heated and of food immediately after cooking; avoidance of unpasteurised milk and fruits and salads washed in suspect water; disinfection of water by boiling or chlorination

Amoebiasis (Amebiasis, Amoebosis, Entamoebiasis): global mortality 40,000-110,000/y, global morbidity 35-50 M; transmitted by cysts of carriers; invasive infection in ≈ 10% of symptomatic cases, extraintestinal amobeiasis in ≈ 5%

Agents: *Entamoeba histolytica*; *Entamoeba polecki* in Australian Aborigines and Papua New Guineans, also S E Asian refugees

Diagnosis: dependent on presentation; ELISA superior to indirect haemagglutination assay in diagnosis of extraintestinal amoebiasis and helps in detecting *Entamoeba histolytica* in otherwise undiagnosed hepatomegaly

Treatment:

Intestinal: see below

Extraintestinal: metronidazole 750 mg 3 times a day for 5-10 d + iodoquinol 650 mg 3 times a day for 20 d; dehydroemetine 1 mg/kg/d to maximum 90 mg/d s.c. or i.m. for 5 d + chloroquine phosphate 600 mg base daily for 2 d then 300 mg base daily for 2-3 w

Intestinal Amoebiasis: incubation period 2 d - 4 w; duration of illness months; fecal-oral transmission and may contaminate water and food; 1% of infective diarrhoea in adults; may be either noninvasive or invasive; carrier state occurs in noninvasive intestinal amoebiasis or may follow any invasive stage; chronic intestinal amoebiasis (chronic amoebic colitis, chronic amoebiasis, chronic amoebic dysentery) has been described

Agent: *Entamoeba histolytica*

Diagnosis:

Noninvasive Intestinal Amoebiasis: as a rule, asymptomatic; no hematophagous trophozoites, changes observable at endoscopy or specific antibodies

Invasive Intestinal Amoebiasis: intermittent diarrhoea, acute dysentery with bloody, mucous stools, colicky pain and rectal tenesmus; may be weight loss and dehydration, fever, constipation, headache, drowsiness, colonic lesions and perforations; incubation period 1 to several weeks

Fulminating Amoebic Colitis: severe form characterised by passage of numerous bloody stools, generalised abdominal discomfort, colicky pains preceding evacuation and rectal tenesmus (often constant and intense), with fever, dehydration and prostration; may be intestinal hemorrhage or perforation

Amoeboma (Amoebic Granuloma): granulomatous tumour-like mass that occasionally develops on intestinal wall

Other Complications: megacolon, peritonitis, amoebic appendicitis and cecitis, cutaneous amoebiasis, rectovaginal amoebic cuffs, hemorrhage, rectovesicular fistulas; acute necrotising colitis with toxic megacolon in 0.5% (associated with > 40% of deaths)

geographic history; incubation period < 21 d; 97% of stools with macroscopic mucus, 37% with macroscopic and 57% with microscopic blood (often in rouleaux), 98% with leucocytes (59% > 10/hpf, variable numbers of mononuclears), 74% pH alkaline; microscopic examination of fresh, warm, liquid feces for hematophagous trophozoites; merthiolate iodine formalin concentration and staining of multiple stool specimens, concentrated by modified Ritchie formalin-ether, and examined stained (iron hematoxylin, trichrome) and as wet mounts for trophozoites and cysts (sensitivity 30-50%, specificity < 60%); sigmoidoscopic swabs and scrapings from large bowel ulcers and biopsies of rectal mucosa; culture adds little in the way of sensitivity or precision to microscopic methods; indirect hemagglutination (10% asymptomatic cyst carriers, < 50% amoebic diarrhoea, 85% invasive amoebic dysentery, > 90% amoebic abscess = 256), counterimmunoelectrophoresis, complement fixation test (diagnostic titre 1:4), latex agglutination, immunodiffusion, ELISA (antigen; stool, sensitivity > 95%, specificity >95%; serum sensitivity > 65%, specificity 90%; salivary IgA diagnostic accuracy 91.5%); indirect immunofluorescence with monoclonal antibodies distinguishes pathogenic (*E.histolytica*) from nonpathogenic (*E.dispar*) strains; negative tests do not exclude intestinal amoebiasis; active infection indicated by presence of specific IgM and IgG; culture and isoenzyme analysis (sensitivity 30-60%, 100% specificity; requires 1-2 w); PCR on stool (sensitivity > 85%, specificity > 90%); colonoscopy; anemia (erythrocyte count and hemoglobin decreased)

Differential Diagnosis:

Dysentery: infections due to *Shigella*, *Campylobacter jejuni*, *Yersinia enterocolitica*, invasive *Escherichia coli*, *Vibrio parahaemolyticus*

Mild Diarrhoea Syndrome: *Salmonella*, giardiasis, enterotoxigenic *Escherichia coli* diarrhoea, many other diarrhoeas of infectious origin, irritable bowel syndrome

Treatment:

Cyst Passers: diloxanide furoate 500 mg orally 3 times daily (child: 20 mg/kg/d in 3 divided doses) for 10 d, iodoquinol 650 mg 3 times daily (child: 30-40 mg/kg/d to 2 g in 3 doses) for 20 d, paromomycin
25-30 mg/kg/d in 3 divided doses for 7 d

Symptomatic: tinidazole 50 mg/kg to 2 g orally daily for 3 d or metronidazole 15 mg/kg to 600 mg orally 8 hourly for 7-10 d, followed by diloxanide furoate 7 mg/kg to 500 mg orally 8 hourly for 10 d or paromomycin 10 mg/kg to 500 mg orally 8 hourly for 7 d or iodoquinol 650 mg 3 times daily for 20 d **Prevention and Control:** sanitation, control of carriers

Bacillary (Bacterial) Dysentery (Shigellosis and Coliform Enteritis)

Shigellosis: ≈ 500 notified cases/y in Australia (≈ 24% in Queensland); incidence in USA 8/100,000 in general population and 494/100,000 in Indian reservations (450,000 estimated total cases, 20% foodborne, 0.8% of foodborne related deaths; 2% of foodborne disease outbreaks, 2% of cases); 2% of infectious diarrhoea (7% in adults; 15% of bloody diarrhoea); transmission by contaminated water and food (usually person-to-person fecal-oral route through ready to eat foods touched by infected workers, raw vegetables, egg salads); duration of illness
4-7 d; case-fatality rate 0.06%; increased risk in men who have sex with men

Agents: *Shigella sonnei* (group D shigellosis, Sonne dysentery; 93% of cases in institutions, 74% in general population, 41% in Indian reservations; very mild infection), *Shigella flexneri* (Flexner dysentery, group B shigellosis, Hiss-Russel dysentery; 7% of cases in institutions, 23% in general population, 58% in Indian reservations), *Shigella boydii* (Boyd dysentery, group C shigellosis; 2-3% of cases), *Shigella dysenteriae* (group A shigellosis, Shiga-Kruse dysentery; serotype 1: Shiga dysentery; serotype 2: Schnitz dysentery; tropics; more serious; 1% of cases), enteroinvasive strains of *Escherichia coli* (≈ 40 notified cases/y in Australia)

Diagnosis: incubation period 12 h - 7 d (usually 24-48 h) in shigellosis, 1-18 h in enteroinvasive *Escherichia coli*; severe diarrhoea, abdominal pain and cramps in 82% of *Shigella* and 91% of enteroinvasive *Escherichia coli*, moderate fever in 40-42% of *Shigella* and 40% of enteroinvasive *Escherichia coli*, slight vomiting in 66% of *Shigella* and 73% of enteroinvasive *Escherichia coli*; age 6 mo - 6 y (rare in neonates), > 50% diarrhoea in household, onset abrupt, bronchitis common, convulsions common, anal sphincter lax tone (rarely rectal prolapse); feces watery and consists largely of mucus (macroscopic in 66-94% of *Shigella* and 66% of enteroinvasive *Escherichia coli*) and blood (macroscopic in 37-63% of *Shigella* and 18% of enteroinvasive *Escherichia coli* and microscopic in 75% of cases), relatively odourless, yellow-green (almost colourless in severe cases) and contains large numbers of neutrophils (in 99% of cases; 44-80% > 10/hpf; 85% of leucocytes) and erythrocytes (18-43%
> 10/hpf; scattered), large macrophages may be present and may have ingested red cells, pH alkaline in 68% of cases; diffuse colitis by sigmoidoscopy; micro, culture (Gram negative broth, xylose lysine deoxycholate agar, MacConkey) and immunofluorescent staining of feces or rectal swab; presence of toxin confirmed by DNA hybridisation and ELISA test; neutrophilia in blood smear; anemia (erythrocyte count and hemoglobin decreased); no satisfactory routine test for identification of *Escherichia coli* strains

Treatment: supportive; antibiotics recommended in all cases for public health reasons; norfloxacin 10 mg/kg to 400 mg orally 12 hourly for 5d (contraindicated in children), cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 5 d, ampicillin 25 mg/kg to 1 g orally 6 hourly for 5 d; in severely ill or immunocompromised, ciprofloxacin 10 mg/kg to 500 mg orally 12 hourly for 5 d; zinc 20 mg/d for 2 w

Prevention and Control: identification and enteric isolation of cases; good hygiene

Cholera (Algid Cholera, Asiatic Cholera, Asphyctic Cholera, Cholera Gravis, Cholera Indica, Cholera Orientalis, Cholera Sicca, Cholera Siderans, Dry Cholera, Epidemic Cholera, Indian Cholera, Malignant Cholera, Pandemic Cholera, Spasmodic Cholera): illness characterised by diarrhoea and/or vomiting; severity is variable; transmission by contaminated water, fish, shellfish, street-vended food; incubation period 24-72 h; duration of illness 3-7 d; principally Africa, Arab countries, India, Indonesia, S America but becoming widespread over Indo-Pacific; few sporadic indigenous cases in Australia (≈ 3 notified cases/y); indigenous focus of infection in crustaceans in Gulf of Maine in USA; incidence in USA 0.3/100,000; global incidence 384,000/y; global mortality 20,000/y; death due to dehydration produced by excess water secretion into small intestine in response to increased activity of adenyl cyclase stimulated by exotoxin of organism; case-fatality rate 0.7%

Agent: *Vibrio cholerae* O1 biotype cholerae (classical cholera; infection:case ratio 5:1-10:1) and biotype eltor (cholera el Tor, cholera El Tor, cholera el tor, cholera eltor; infection:case ratio 25:1-100:1)

Diagnosis: 75% asymptomatic, 18% mild, 5% moderate, 2% severe; abrupt onset of profuse watery diarrhoea; 58% > 10 stools/d, 88% watery, 8% mucus, 4% blood; explosive), occasional vomiting, fever absent, respiratory symptoms absent, occasional convulsions, anal sphincter normal, saline depletion, hypotension; stools innocuous odour, clear, rice water; geographic history; micro (leucocytes absent; organisms seen in Gram or on phase or dark field) and culture of feces or vomit on thiosulphate citrate bile sucrose medium (enrichment in alkaline peptone water will increase yield), with isolation of cholera toxin-producing *Vibrio cholerae* O1 or O139 (confirmed by DNA hybridisation and ELISA test); serologic evidence of recent infection (ELISA; sensitivity 85-100%)

Treatment: rehydration and electrolyte replacement (severe dehydration: i.v. Ringer's lactate; less severe: oral rehydration with sodium chloride 3.5 g/L + sodium citrate dihydrate 2.9 g/L or sodium bicarbonate 2.5 g/L + potassium chloride 1.5 g/L + anhydrous glucose 20 g/L + zinc 40 mg/L in clean drinking water); antibiotics reduce volume and duration of

diarrhoea; doxycycline 2.5 mg to 100 mg orally 12 hourly for 3 d (not in < 8 y, pregnant or breastfeeding), ciprofloxacin 25 mg/kg to 1 g orally single dose (not pregnant or children), norfloxacin 400 mg twice a day for 3 d (not pregnant or children), tetracycline 30-40 mg/kg to 500 mg orally 6 hourly for
3 d (not in < 8 y, pregnant or breastfeeding), erythromycin 250 mg orally 4 times daily (child: 10 mg/kg 3 times daily) for 3 d, azithromycin 20 mg/kg single dose, cotrimoxazole

Pregnant, < 8 y: amoxycillin 10 mg/kg to 250 mg orally 6 hourly for 5 d

Carriers: oral streptomycin or neomycin

Prophylaxis: no vaccine currently licensed and available; 'boil it, cook it, peel it or forget it'; improved sanitation; postexposure: doxycycline 2 mg/kg to 100 mg orally daily

ENTEROTOXEMIA: preformed toxin in food

Agents: *Staphylococcus aureus* (185,000 estimated cases/y in USA, all foodborne, 0.1% of foodborne related deaths; 2% of foodborne outbreaks, 2% of cases; heat-stable toxin in unrefrigerated or improperly refrigerated cream pastries, meats, potato and egg salads; duration of illness 24-48 h), *Clostridium perfringens* type A (heat-stable toxin in meats, poultry, gravy, dried or precooked foods kept warm for several hours; duration of illness 24-48 h; 18% of foodborne disease outbreaks in Australia; 250,000 estimated cases/y in USA, all foodborne, 0.4% of foodborne related deaths; 2% of foodborne disease outbreaks, 3% of cases), *Clostridium botulinum* (8-66% mortality; heat-labile toxin in home-canned foods with low acid content, improperly canned commercial foods, home-canned or fermented fish, herb-infused oils, baked potatoes in aluminium foil, cheese sauce, bottled garlic, foods held warm for extended periods; no notified cases in Australia in past decade), *Bacillus cereus* (diarrhoeal toxin from meats, stews, gravies, vanilla sauce; vomiting toxin from improperly refrigerated cooked and fried rice, meats;
27,000 estimated cases/y in USA, all food borne, no deaths; 0.5% of foodborne disease outbreaks, 0.8% of cases)

Diagnosis: isolation of organism from suspect food (chopped meat, blood agar, phenylethyl alcohol blood agar, mannitol salt agar, tryptose sulphite cycloserine agar) and feces; identification of toxin (ELISA) from feces, serum (≈ 3-5 mL transported at 4ºC) and foodstuff; CSF pressure, cell count, glucose and protein normal

***Staphylococcus aureus*:** sudden onset of very severe nausea, retching and vomiting and abdominal pain and cramps, slight diarrhoea in 39% of cases, little or no fever, acute prostration; incubation period 0.5-6 h

Clostridium perfringens: very severe abdominal pain and cramps, moderate watery diarrhoea in 91% of cases, vomiting rare, little or no fever, nausea and headache rare; incubation period 8-16 h; toxin test on stool

Clostridium botulinum: moderate bulbar signs, vertigo, double or blurred vision, loss of reflex to light, difficulty in swallowing, speaking and breathing, dry mouth, descending muscle weakness, respiratory paralysis; slight vomiting, diarrhoea in some cases; incubation period 2 h - 8 d; duration of illness days to months; toxin test on stool, serum and food

***Bacillus cereus*:** diarrhoeal toxin: abdominal cramps, nausea, watery diarrhoea, incubation period
10-16 h, duration of illness 24-48 h; vomiting toxin: sudden onset of nausea and vomiting ± diarrhoea, incubation period 1-6 h, duration of illness 24 h; test food and stool for toxins in outbreaks

Treatment: supportive

***Clostridium botulinum*:** antitoxin

Prophylaxis (Botulism): hyperimmune immunoglobulin

CIGUATERA FISH POISONING: pantropical; 13% of foodborne disease outbreaks in Australia; 2% of foodborne disease outbreaks in USA, 0.2% of cases, no deaths

Agent: ciguatoxin and 5 other toxins produced by *Gambierdiscus toxicus* (a diatom) eaten by fish (coral reef fish, barracuda, grouper, amberjack, red snapper), which concentrate toxin and remain toxic 2 y

Diagnosis: clinical: gastrointestinal symptoms (abdominal pain, nausea, vomiting, diarrhoea) 2-6 h post-ingestion, neurologic (paresthesias of lips, tongue and extremities, reversal of hot and cold, pain and weakness of lower extremities, acral tingling, myalgia, itching, insomnia, headache, numbness and aching teeth usually present; dizziness, dry mouth, dilated pupils, blurred vision, paralysis, seizures, coma and death (rarely) also occur) 3 h post-ingestion, cardiovascular (bradycardia, hypotension, increase in T wave abnormalities) after 2-5 d; duration of illness days to months; radioassay for toxin in suspect fish

Treatment: supportive, i.v. mannitol, tocanide, amitryptyline (25 mg twice a day), nifedipine

NEUROTOXIC SHELLFISH POISONING: Caribbean, Gulf of Mexico

Agent: ≥ 10 brevetoxins produced by *Karenia brevis* and concentrated by shellfish; most common in US Gulf States; marine mammal deaths

Diagnosis: clinical (incubation period 2 min-4 h; reversal of hot and cold sensation, nausea, vomiting, diarrhoea, tingling and numbness of lips, mouth, tongue, throat and face, muscle aches, dizziness, ataxia, asthma-like respiratory distress, often a feeling of floating); history of shellfish (mussels, plankton feeders) ingestion; detection of toxin in shellfish
Treatment: supportive; activated charcoal and cathartic if severe
Paralytic Shellfish Poisoning: subarctic to tropic (primarily American Samoa, California, Washington, New England
Agent: saxitoxin (blocks sodium channels) and ≥ 21 other toxins produced by *Gonyaulax* and *Alexandrium* and concentrated by finfish and shellfish
Diagnosis: clinical (incubation period 30 min to 3 h; diarrhoea, nausea, vomiting, abdominal pain, paresthesias of extremities, tingling, burning, numbness of mouth and lips, drowsiness, incoherent speech, ataxia (rare), respiratory paralysis (rare), death (rare)); history of shellfish (mussels, clams, scallops, cockles) ingestion; duration of illness days; detection of toxin in food or water where fish located
Treatment: supportive; activated charcoal and cathartic if severe; may be life-threatening and need respiratory support
Diarrhoeic Shellfish Poisoning: Europe, Canada, Japan, New Zealand, South America, seen in US waters
Agent: dinophysis toxin, okadaic acid, pectenotoxin, yessotoxin produced by *Dinophysis*
Diagnosis: ingestion of a variety of shellfish, primarily mussels, oysters, scallops, shellfish from Florida coast and Gulf of Mexico; incubation period 30 min to 2 h; abdominal pain, vomiting, nausea, headache, diarrhoea, chills, fever; duration of illness hours to 3 d; demonstration of toxin in shellfish
Treatment: supportive
Scombroid Poisoning: 4% of foodborne disease outbreaks in Australia; 3% of foodborne disease outbreaks in USA, 0.3% of cases, no deaths
Agent: histamine produced by bacterial action on flesh of certain fish (tuna, mackerel, mahi-mahi, bonito, bluefin, skipjack, marlin)
Diagnosis: incubation period 1 min-3 h; dizziness, headache, respiratory symptoms, nausea, vomiting, peppery taste, burning of mouth, throat and skin, facial swelling and flushing, stomach pain, itching of skin, rash, urticaria, paresthesias; duration of illness 3-6 h; demonstration of histamine in food
Treatment: gastric lavage, antihistamine, cimetidine, bronchodilators if wheezing or asthmatic
Tetrodoxin Poisoning: kills 70-100/y in Japan
Agent: tetrodoxin from blowfish (puffer, globefish, swellfish, fugu)
Diagnosis: tingling about lips and tongue and feeling as though floating, followed by motor incoordination within 10-45 min, then paralysis, difficulty swallowing and loss of voice; death due to respiratory paralysis in > 60%
Amnesic Shellfish Poisoning: Canada, NE USA, Washington, Oregon, California
Agent: domoic acid produced by *Pseudo-nitzchia pungens* and other species and concentrated by shellfish (especially mussels) and finfish
Diagnosis: gastroenteritis, memory defects/amnesia, confusion, death (4%)
Treatment: supportive
Infant Botulism: in infants < 12 mo; associated with honey, home-canned vegetables and fruits, infant formula
Agent: *Clostridium botulinum*
Diagnosis: incubation period 3-30 d; duration of illness variable; weakness or floppiness in 88%, poor feeding in 79%, constipation in 65%, weak cry in 18%, irritability in 18%, respiratory difficulties in 11%, seizures in 2%; electromyogram (compound muscle action potentials of decreased amplitude in at least 2 muscle groups; tetanic and post-tetanic facilitations defined by an amplitude of > 120% of baseline; prolonged post-tetanic facilitation of > 120 s and absence of post-tetanic exhaustion); toxin identification (mouse bioassay, ELISA) from stool (25-50 g without transport medium transported at 4°C), serum, food; recovery of *Clostridium botulinum* from stool and suspect materials
Treatment: supportive; botulism immune globulin
Bacterial Gastroenteritis (Bacterial Enteritis): although toxins may be produced and play a role in disease causation, the condition arises from a true infection and is not only an intoxication; most common cause (14%) of fever in returned travellers to Australia
Agents: *Salmonella* (≈ 7000 notified cases/y in Australia (≈ 31% in Queensland), 46% of foodborne disease outbreaks; incidence 12/100,000 in USA (1.4 M estimated total cases, 95% foodborne, 31% of foodborne related deaths; 13% of foodborne disease outbreaks, 38% of cases); 34% of infectious diarrhoea in adults; 6% of bloody diarrhoea; mortality < 1%; infection from contaminated eggs, poultry, fish, ham, beef, gravy, meat pies, sausages, raw fruits and vegetables, unpasteurised milk or juice, soft cheese or fecal contamination; duration of illness

4-7 d), *Yersinia enterocolitica* (2% of infectious diarrhoea; ≈ 140 notified cases/y in Australia (general decline; ≈ 70% in Queensland); incidence 0.5/100,000 in USA (100,000 estimated total cases, 90% foodborne, 0.1% of foodborne related deaths); vehicle contaminated water and unpasteurised milk, juice or soft cheeses in outbreaks, undercooked pork in sporadic cases), *Plesiomonas shigelloides* (1% of infectious diarrhoea in adults; occasional bloody diarrhoea; occasional outbreaks and sporadic cases, chiefly in tropical areas), *Vibrio parahaemolyticus* (0.7% of infectious diarrhoea in adults; from fish, shellfish and processed seafood; duration of illness 24-72 h), *Aeromonas hydrophila* (0.7% of infectious diarrhoea in adults), enterotoxigenic (undercooked hamburger, unpasteurised juices) and enteropathogenic adhesion factor positive *Escherichia coli* (dyspepsiacoli diarrhoea, *Escherichia coli* diarrhoea;
< 1% of infectious diarrhoea; > 10^6 bacteria in food or water), *Clostridium perfringens* (uncommon), *Vibrio cholerae* non-O1, *Vibrio mimicus, Vibrio fluvialis, Vibrio furnissi, Vibrio hollisae* and *Vibrio vulnificus* (vehicle shellfish), *Listeria monocytogenes* (usually milk products (unpasteurised soft cheeses); also raw hot dogs, deli meats; ≈ 60 notified cases/y in Australia, 4% of foodborne disease outbreaks; incidence 0.4/100,000 in USA (3000 estimated total cases, 99% foodborne, 28% of foodborne related deaths; 0.1% of foodborne disease outbreaks, 0.1% of cases)), rarely *Enterococcus faecalis, Enterococcus faecium, Proteus, Alcaligenes faecalis, Pseudomonas aeruginosa* ('Shangai fever'; presentation similar to typhoid fever), *Edwardsiella tarda*

Diagnosis: micro (leucocytes (75% polymorphonuclears) but usually not erythrocytes) and culture (blood agar, enteric and differential agar media) of feces; ELISA for antibody (*Salmonella enteritidis* sensitivity 92%, specificity 100%; *Salmonella typhimurium* sensitivity 100%; *Yersinia enterocolitica* sensitivity 86%, specificity 100%); toxin assay (*Clostridium perfringens*)

***Salmonella*:** moderate vomiting in 56%, diarrhoea, abdominal pain and cramps in 75%, variable fever in 27%, chills, malaise, nausea, headache, prostration, respiratory symptoms uncommon, convulsions rare, anal sphincter normal; stools loose, slimy, foul odour (rotten eggs), blood in 26%, colour green, mucus variable; incubation period 1-3 d; TUBEX detects IgM antibodies to *Salmonella enteritidis* (sensitivity 93%, specificity 95%)

***Vibrio parahaemolyticus*:** nausea and vomiting, severe abdominal pain and acute watery diarrhoea; incubation period 2-48 h

Vibrio vulnificus: vomiting, diarrhoea, abdominal pain, bacteremia, may be wound infections; more common in immunocompromised and patients with chronic liver disease (associated bullous skin lesions); incubation period 1-7 d; duration of illness 2-8 d; from undercooked or raw shellfish (especially oysters), other contaminated seafood (also open wounds exposed to sea water); stool cultures on thiosulphate citrate bile sucrose agar; wound and blood cultures if indicated

Yersinia enterocolitica: diarrhoea, vomiting, fever, abdominal pain; appendicitis-like symptoms primarily in older children and young adults; incubation period 24-48 h; duration of illness 1-3 w; occasionally bloody diarrhoea; culture of stool or vomitus on CIN medium; blood culture; serology (research and reference laboratories)

Enterotoxigenic *Escherichia coli*: 99% diarrhoea, 79-82% abdominal pain and cramps, 73% watery stool, 49% nausea, 17-22% fever, 14-54% vomiting; 10% severe hemorrhagic colitis; median incubation period 42 h (72-120 h); duration of illness 24-265 h; 87% of cases 5-10 stools/d, 78% watery, 40% mucus, 12% blood, no leucocytes; test for toxin production in Chinese hamster ovary cells

Enteropathogenic adhesion factor positive *Escherichia coli*: 81% watery stool, 69% vomiting, 44% abdominal pain, 19% fever; incubation period 12-74 h

Treatment: antibiotics are not usually required and, especially in salmonellosis, prolong carriage, as do agents (eg., Lomotil™) decreasing intestinal motility; patients with AIDS or lymphadenopathic syndrome, oncology patients and, possibly, patients > 50 y, infants < 3 mo and malnourished children should, however, receive antibiotic treatment, as should systemic infections; dehydration requires hospitalisation and fluid replacement under biochemical control

***Salmonella*:** ciprofloxacin 10 mg/kg to 500 mg orally 12 hourly for 5-7 d, azithromycin 20 mg/kg to 1 g orally on first d then 10 mg/kg to 500 mg daily for further 6 d; if oral therapy cannot be tolerated, ciprofloxacin 10 mg/kg to 400 mg i.v. 12 hourly until oral ciprofloxacin can be tolerated, ceftriaxone 50 mg/kg to 2 g i.v. daily until oral ciprofloxacin or azithromycin can be tolerated

***Yersinia enterocolitica* (Severe Cases):** gentamicin 1.3 mg/kg (child: 1.5-2.5 mg/kg) i.v. 8 hourly, cefotaxime, ceftriaxone, ciprofloxacin, doxycycline

***Vibrio parahaemolyticus* (Severe Cases):** tetracycline, doxycycline, gentamicin, cefotaxime

Vibrio vulnificus: supportive care + tetracycline, doxycycline or ceftazidime

Aeromonas: chloramphenicol, ciprofloxacin, aminoglycosides, third generation cephalosporins, aztreonam, imipenem

Plesiomonas shigelloides: chloramphenicol, aminoglycosides, cotrimoxazole, fluoroquinolones, tetracycline, third generation cephalosporins, imipenem

Listeria monocytogenes: ampicillin, cotrimoxazole
Enterotoxigenic *Escherichia coli:* cotrimoxazole
Enteropathogenic *Escherichia coli:* ampicillin, cotrimoxazole
Enteroinvasive *Escherichia coli* (Severe Cases): quinolones

GASTROENTERITIS also occurs with infections with *Taenia saginata, Taenia solium, Trichinella spiralis,* on ingestion of ciguatera toxin, tetraodon toxin and *Muscaria*-type mushrooms and in organic phosphate poisoning. Gastrointestinal distress is common in influenza and occurs in 15% of parainfluenza cases. Gastrointestinal hemorrhage is extensive in Ebola hemorrhagic fever and occurs in neonatal *Simplexvirus* infection and in 13% of cases of brucellosis. Gastrointestinal symptoms are also seen in 94% of cases of toxic shock syndrome.

ENTERIC FEVER (EBERTH DISEASE): acute febrile disease; transmission by contact, water or food; epidemics often related to fecal contamination of water supplies or street-vended foods; may take numerous clinical forms; 80% in Asia, 20% in Latin America, Africa; global incidence 16M/y (600,000 deaths/y)

Agents: *Salmonella typhi* (typhoid fever, continued fever, febris typhoidea, ileotyphus, lent fever, nightsoil fever, pythogenic fever, typhoenteritis, typhogastric fever, typhus abdominalis; prevalent in Africa, Asia (13 M cases and > 440,000 deaths/y) and Mediterranean basin; causes epidemics anywhere; 0.4% of infectious diarrhoea; ≈ 70 notified cases/y in Australia (≈ 53% in NSW; causes 3% of fever in returned travellers); incidence 0.2/100,000 in USA; case-fatality rate 0.1-41%; perforation (case-fatality rate 0-100%) in 0-21% of cases), *Salmonella paratyphi A* (febris paratyphoidea A, paratyphoid A fever, paratyphoid fever A, paratyphus A; largely confined to tropics but also other Asia, Western Europe), *Salmonella enterica subsp Salmonella enteric I* serovar paratyphi B (Brion-Kayser disease, febris paratyphoidea B, paratyphoid B fever, paratyphoid fever B, paratyphus B, Schottmüeller disease; Europe), *Salmonella enterica subsp Salmonella enteric I* serovar paratyphi c (febris partyphoidea C, paratyphoid C fever, paratyphoid fever C, paratyphus C)

Diagnosis: gradual onset (incubation period 7-28 d), prolonged fever (≥ 39°C in 90%), malaise, headache, nausea, constipation, abdominal pain, chills, myalgia, rose spots, splenomegaly, hepatomegaly, diarrhoea and vomiting uncommon, nonproductive cough common, occasional convulsions, anal sphincter normal; stools foul odour, brown; 49% of cases with 10 stools/d, lasting 6+ d, 98% watery, 7% bloody, 2% soft, 29% guiac test positive, 52% 1-9 erythrocytes/hpf, 74% 0-19 leucocytes/hpf, 4950 leucocytes/µL, 70% polymorphs, 30% mononuclears, protein 9.3 g/L, sodium 47 mEq/L, potassium 48 mEq/L, chloride 43 mEq/l, pH 6.1; history of foreign travel, especially Mexico and India; blood culture X2 + bone marrow culture (most reliable single method) + duodenal string culture; hypochromic anemia (erythrocyte count and hemoglobin decreased), neutropenia or neutrophilia; serum alkaline phosphatase 30 IU/L, serum bilirubin 2 mg/dL, serum glutamic pyruvic acid transaminase 16-170 U/mL in 35% of cases, serum CO_2 24 mmol/L; elevated antibody titres to hemagglutinin; Widal test (agglutinins to O antigens of groups A, B, C or D or H antigen elevated in infections; cross-reactions between groups B, C and D common; high H titre in prior immunisation); radioimmunoassay (sensitivity 94%, specificity 100%)

Treatment: ciprofloxacin 15 mg/kg to 500 mg orally or 10 mg/kg to 400 mg i.v. 12 hourly for 7-10 d; if reduced susceptibility to quinolones or fever > 7 d, ceftriaxone 50 mg/kg to 2 g i.v. once daily or azithromycin 20 mg/kg to 1 g i.v. or orally daily till clinical response, then amoxicillin 25 mg/kg to 1 g orally 6 hourly for further 14 d, azithromycin 20 mg/kg to 1 g orally daily for total 10 d or cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 14 d; + dexamethasone 3 mg/kg in critically ill patients in shock; + aggressive resuscitation, prompt operative intervention and careful postoperative attention to hydration and nutrition in perforation

Carriers: norfloxacin 400 mg orally 12 hourly for 28 d, ciprofloxacin 750 mg orally twice daily for 28 d, ofloxacin; amoxycillin 50-75 mg/kg daily in 3 divided doses orally or i.v. + probenecid 30 mg/kg (child: 10-15 mg/kg) orally daily in divided doses for 6 w

Prophylaxis (*Salmonella typhi*): heat-killed whole cell vaccine (protection rate 70-90%; contraindicated in pregnancy and convalescence from serious illness); Vi conjugate vaccine (71-88% efficacy after single dose, 92% after 2 doses; lower fever and systemic adverse effects); live oral vaccine (protection rate 70-95%; contraindicated in pregnancy, acute gastrointestinal infections, AIDS, treatment with antimitotic or immunosuppressive drugs); good sanitation

DIARRHOEA RELATED TO BACTERIAL OVERGROWTH

Agents: mixed bacterial species in high numbers

Diagnosis: chronic diarrhoea; culture of duodenal aspirate; glucose ingestion hydrogen breath test

Treatment: norfloxacin 800 mg/d for 7 d, amoxycillin-clavulanate 1500 mg/d for 7d, rifaximin 1600 mg/d

ENTERITIS: 0.2% of new episodes of illness in UK

Agents: *Giardia lamblia* (2 M estimated cases/y in USA (10% foodborne, 0.1% of foodborne related deaths); 1% of infective diarrhoea in adults; swallowing water while swimming, recreational fresh water contact, drinking treated tap water, eating lettuce), *Chilomastix mesnili, Cystoisospora belli* (probably worldwide infection of mammals; frequently asymptomatic infection of workers in contact with farm animals, usually pigs; frequent cause (15% in Haiti) of severe diarrhoea in AIDS), *Sarcocystis, Cryptosporidium* (worldwide in most mammals; incidence varies widely from 2.4/100,000 in USA (300,000 estimated total cases (10% foodborne), 0.4% foodborne related deaths) to 9.2% in parts of Africa), *Cyclospora cayetanensis* (Americas, Africa, Indian subcontinent, South-east Asia; incidence 0.1/100,000 in USA (16,000 estimated total cases, 90% foodborne, no deaths); transmitted in contaminated water, berries, lettuce, basil, salad), *Blastocystis hominis* (claimed to cause an acute enteritis but probably rarely, if ever, a human pathogen), *Encephalitozoon cuniculi, Enterocytozoon bieneusi* and *Encephalitozoon intestinalis* (chronic diarrhoea in AIDS), *Nosema* (immunocompromised), *Microsporidium* (immunocompromised), *Balantidium coli* (balantidiasis, balantidial colitis, balantidial dysentery, balantidiosis, balantidosis, ciliary dysentery, ciliate dysentery; worldwide; derived from pigs' feces), *Schistosoma japonicum, Schistosoma mansoni, Fasciola hepatica, Fasciolopsis buski, Dicrocoelium dendriticum, Dicrocoelium hospes, Paragonimus westermani, Nanophyetus salmincola* (10 cases in USA from eating raw, smoked or incompletely cooked salmon or steelhead trout), *Skrjabinophytus neomidis* (endemic in Siberia; infection rates up to 98%), *Opisthorchis, Clonorchis sinensis* (Southeast Asia; incidence 28M/y; no deaths reported), *Heterophyes, Metagonimus, Taenia saginata* (beef tapeworm), *Taenia solium* (pork tapeworm; cysticerci ingested in inadequately cooked pork; adult worm in intestines; eggs in feces), *Echinococcus granulosus* and *Echinococcus multilocularis* (hydatid disease; 15 cases/y in Australia), *Hymenolepis diminuta, Hymenolepis nana, Dipylidium caninum, Diphyllobothrium* (fish tapeworm; foci in Finland, Japan, Romania, Switzerland and Northern USSR; also found in Canada and Alaska in USA), *Trichinella spiralis* (incidence 0.06/100,000 in USA; attack rate 81%; case-fatality rate 9-10/1000; prevalence in USA 2%; farm-raised hogs 1/1000, garbage-fed hogs 5/1000; transmission by raw or undercooked infected meat (usually pork or wild game such as bear or moose); incubation period 1 d-8 w; prevention and control by adequate cooking or freezing), *Trichuris trichuria* (whipworm; worldwide prevalence 350 M; especially hot, wet areas, also temperate areas), *Capillaria philippinensis, Strongyloides fuelleborni* and *Strongyloides stercoralis* (usually chronic or recurrent—40+ y; persistent in 20% of all World War II prisoners in Burma-Thailand camps and in 50% of those with symptoms), hookworm (*Ancyclostoma ceylanicum, Ancyclostoma duodenale, Necator americanus*; all tropical and subtropical countries; 700 M cases/y worldwide; transmission by skin contact with contaminated soil; incubation period 2-10 w; prevention by sanitation, wearing of shoes), *Trichostrongylus, Enterobius vermicularis* (pinworm; worldwide; commonly seen in children), *Ascaris lumbricoides* and *Ascaris suum* (150M cases/y worldwide; Africa, Asia, Latin America; 60 000 deaths/y; > 2000 cases/100,000 in China; fecal transmission; incubation period 2 mo; prevention and control by sanitation), *Anisakis simplex, Pseudoterranova, Physaloptera caucasia, Toxoplasma gondii* (225,000 estimated cases/y in USA, 50% foodborne, 21% of foodborne related deaths)*;* larvae of flies of Order Diptera (*Calliphora vomitoria, Chrysomya chloropyga, Chrysomya putoria, Clogmia albipunctata, Eristalis tenax, Fannia canicularis, Gasterophilus haermorrhoidalis, Gasterophilus intestinalis, Gasterophilus nasalis, Musca domestica, Piophila, Sarcophaga bullata, Sarcophaga hirtipes, Sarcophaga ilerminieri, Sarcophaga peregrina, Sarcophaga ruficornis, Sarcophaga sarraceniae, Sarcophaga striata*); *human cytomegalovirus* in AIDS

Diagnosis:

***Giardia lamblia*:** vehicle drinking water, contaminated food; incubation period 1-4 w; malaise, gastric pain, malabsorption; diarrhoea > 5 d, recurrent, mucoid, fatty stools; bloating, flatulence, nausea, vomiting, anorexia, weight loss, no fever; no leucocytes or erythrocytes in stool micro; trophozoites in diarrheic and cysts in formed faeces (modified Ritchie formalin-ether concentration); trophozoites in duodenal or jejunal aspirate or biopsy; solid phase qualitative immunochromographic assay (ColorPac Giardia/Cryptosporidium; ≈ 1% false positives, no false negatives); serology for *Giardia lamblia* IgG; ELISA (sensitivity 84-98%, specificity 97-100%, positive predictive value 73%, negative predictive value 97%)

***Chilomastix mesnili*:** trophozoites in unformed and cysts in formed stools

***Cryptosporidium* and *Isospora*:** vehicle water, vegetables, fruits, unpasteurised milk; incubation period 2-28 d; usually mild and self-limited but severe clinical symptoms reported; acute onset malaise, bloating, abdominal pain and cramping, weight loss, watery mucoid diarrhoea, malabsorption ± fever, vomiting; no leucocytes or erythrocytes in stool micro; oocysts in fresh warm stools; iodine stained wet preparation; phase contrast examination of Sheather's sugar flotation concentrate; sedimentation and modified acid-fast staining; indirect fluorescent antibody; solid phase qualitative immunochromographic assay (ColorPac Giardia/Cryptosporidium; ≈ 1% false positives, no false negatives); duodenal aspirate; histology of small or large bowel biopsy

Cyclospora: incubation period 1-11 d; protracted intermittent diarrhoea (may alternate with constipation, often relapsing) in 96% (watery in 96%, mucus in 61%, no blood), flatulence in 96%, weight loss in 92%, nausea in 92%,

abdominal cramps in 79%, vomiting in 53%, fever in 43%, fatigue, indigestion, malaise, bloating, anorexia, myalgia, 'flu-like' symptoms; symptoms last up to 7 w in immunocompetent and up to 4 mo in AIDS patients; Reiter syndrome and Guillain-Barré syndrome reported; characteristic unsporulated oocysts in wet film or modified acid-fast stain

Sarcocystis: usually asymptomatic; may be acute episode of abdominal pain and diarrhoea or, in prolonged infections, recurrent abdominal manifestations; patients with at least 500 flukes show rumbling on palpation of sigmoid and cecum, diarrhoea and gastric pain

***Blastocystis hominis*:** visualisation of parasite in wet films or stained by modified Ziehl-Neelsen stain

Microsporidia: incubation period 1-2 w; malabsorptive diarrhoea with bloating; no fever; systemic dissemination to liver, gall bladder, sinuses, muscle, eye and central nervous system can occur with *Encephalitozoon intestinalis*; no leucocytes or erythrocytes in stool micro; examination of stool by modified trichrome stain (technique of Weber et al) or fluorescence, Giemsa stained smear of small intestinal biopsy

Balantidium coli: may be asymptomatic, acute or chronic; alternating diarrhoea and constipation, dysentery, abdominal colic, tenesmus, nausea, vomiting; especially in malnourished children, deep penetrating ulceration of colon may be caused; fulminating dysentery, intestinal perforation, hemorrhage and shock are rare, sometimes fatal, complications; trophozoites in diarrheic and cysts in formed feces; anemia (erythrocyte count and hemoglobin may be decreased)

Schistosoma: diarrhoea in 66% of cases of acute schistosomiasis (31% bloody); urogenital disturbances; ova in faeces (acid-ether concentration) or in rectal and colonic granulomata*;* counterimmunoelectrophoresis, indirect hemaglutination titre; eosinophilia in all cases of acute schistosomiasis

Fasciola hepatica: vomiting, irregular fever, right upper quadrant pain, diarrhoea, jaundice, hepatomegaly; may be fatal; geographic history; dietary history; ova in feces; complement fixation test, precipitin, counterimmunoelectrophoresis, indirect haemagglutination (experimental); eosinophilia, increased ESR, erythrocyte count and hemoglobin may be decreased

Fasciolopsis buski: abdominal pain, nausea, diarrhoea with greenish-yellow stools containing undigested food; may be edema of face, abdomen and legs, dry skin and extreme prostration; may be fatal; geographic history; dietary history; ova and sometimes adult trematodes in feces; anemia (erythrocyte count and haemoglobin decreased) and eosinophilia

***Dicrocoelium hospes*:** constipation and diarrhoea, flatulence, vomiting, hepatomegaly, toxemia; presence of eggs in feces not necessarily proof of infection

***Paragonimus westermani*:** cough, hemoptysis, chest pain, epilepsy; geographic history; dietary history; ova in feces and sputum; complement fixation test; eosinophilia, anemia (erythrocyte count decreased)

***Nanophyetus salmincola*:** ingestion of salmonid fish; diarrhoea, abdominal discomfort, anorexia, vomiting, weight loss; blood eosinophilia; visualisation of ova in feces

***Opisthorchis*:** mild disease usually asymptomatic; heavy infection manifested by fever, anorexia, epigastric pain, diarrhoea, weight loss, hepatosplenomegaly, jaundice; ingestion of raw or inadequately cooked freshwater fish

***Clonorchis sinensis*:** mild infection usually asymptomatic; fever, anorexia, epigastric pain, hepatomegaly, jaundice, obstruction of bile ducts, diarrhoea, cirrhosis, portal hypertension; eating raw or inadequately cooked freshwater fish; ova in stools, bile or urine; complement fixation test, indirect hemagglutination; eosinophilia, anemia (erythrocyte count and hemoglobin may be decreased)

***Heterophyes* and *Metagonimus*:** mild disease usually asymptomatic; heavy infection characterised by diarrhoea with bloody mucoid stools, abdominal pain, neurasthenia, eosinophilia; ingestion of raw or inadequately cooked freshwater fish

***Taenia saginata*:** ingestion of beef; most frequently, disagreeable sensation in perianal area due to migratory proglottids; may be abdominal pain, hunger pains, diarrhoea, weight loss or gain, nervousness, insomnia, anorexia; incubation period 3-6 mo; at times, proglottids inside appendix or bladder causing appendicitis or cholecystitis; segments or motile proglottids may be passed; gravid segments, ova (by formalin-ether concentration), scolices in faeces; ova on cellophane swab of perianal area; serology by indirect fluorescent antibody titre; eosinophilia in 10% of cases

***Taenia solium*:** ingestion of pork; often asymptomatic, but may be manifested by vague abdominal pain, headache, indigestion, alternating diarrhoea and constipation, weight loss, insomnia, hunger pains, anorexia; in children and debilitated adults, may be nervous manifestations (nervousness, epilepsy, mental disorders); incubation period 3-6 mo; segments may be passed; segments, ova (by formalin-ether concentration), scolices in feces or from perianal area; serology by indirect fluorescent antibody titre; eosinophilia commoner in simple enteritis than in cysticercosis

Echinococcus: cysts in liver, lung, brain, spleen, orbit, soft tissues; abdominal ultrasound or CT and CT or MRI of chest and brain

Hymenolepis: mild infection usually asymptomatic, but severe toxemia, manifested by abdominal pain, diarrhoea, headache, nasal and oral pruritus, dizziness, epileptiform convulsions and other disturbances of CNS, may occur; ova in faeces 30 d after infection; anaemia, eosinophilia

***Dipylidium caninum*:** usually asymptomatic; sometimes, epigastric pain, indigestion, loss of appetite, diarrhoea, anal pruritus

***Diphyllobothrium*:** often asymptomatic; abdominal pain and discomfort, constipation, diarrhoea, vomiting, intestinal obstruction; ingestion of uncooked freshwater fish; segments may be passed; ova or proglottids in faeces or vomitus; scolex required for species identification; if attached high in small intestine, segments vomited; occasionally produces megaloblastic anaemia with low serum B_{12}

***Trichuris trichuria*:** light infections very common and usually asymptomatic; heavy infections usually manifested by headache and abdominal pain; rectal prolapse may occur, especially in children; haemorrhagic colitis rare complication; ingestion of soil, raw vegetables or fruit; ova in faeces (modified Ritchie formalin-ether concentration); larvae and adult worms in surgical specimens of appendix and caecum; counterimmunoelectrophoresis; eosinophilia in 25% of cases, anaemia (erythrocyte count and haemoglobin may be decreased)

Capillaria philippinensis: recurrent abdominal pain and intermittent diarrhoea; severe protein-losing enteropathy with malabsorption of fats and sugars; weight loss, anorexia and vomiting common; case-fatality ratio high; several relapses over 2-3 y usual after recovery from initial attack; transmitted by eating undercooked and raw fish; microscopy of faeces for ova

***Strongyloides stercoralis*:** mild to severe gastrointestinal symptoms (mucous diarrhoea, frequently alternating with constipation; abdominal crampy pain, heartburn) in 42%, 25% asymptomatic, 22% skin complaints (recurrent pruritic rash in 25% of all World War II prisoners in Burma-Thailand), 7% pruritus ani, 4% fever; 100% mortality in untreated hyperinfection in immunocompromised; rhabditiform and occasionally filariform larvae in fresh stools (Baerman stool concentration most sensitive), duodenal aspirate; larval antigen ELISA; indirect haemagglutination; neutrophilia followed by leucopenia, up to 40% eosinophilia (83% > 400 eosinophils/μL; increased mortality with lower eosinophilia), anaemia (erythrocyte count and haemoglobin may be decreased); ELISA (sensitivity 95%)

Hookworm: usually asymptomatic; severe disease characterised by diarrhoea with blood-stained stools, epigastric pain, mental apathy or retardation, weight loss, oedema, puffy face, changes in renal function, ulcer, retarded growth; may be cardiovascular complications and secondary malabsorption syndrome; ova and larvae in faeces by brine flotation; indirect haemagglutination; iron deficiency anaemia (erythrocyte count and haemoglobin decreased), hypoproteinemia, eosinophilia

Necator americanus: initial dermatitis occurs less often; anaemia usually less severe

***Trichostrongylus*:** usually no signs or symptoms but heavy infections may result in change to mucosa, anaemia, dry skin and emaciation; ova or adult worms in stool

***Enterobius vermicularis*:** perianal pruritus, poor appetite, irritability and insomnia due to female worms migrating through anus at night, abdominal pain, dysentery, rectal prolapse; secondary migration of worms into unusual sites elicits granuloma formation in appendix, fallopian tubes and peritoneal cavity; distant metastatic spread in liver and lung and in urethra of homosexual men; ova in perianal scrapings or sticky tape preparation, occasionally in faeces; adult worms in faeces and occasionally in appendices at operation; eosinophlia common, sometimes neutrophilia

Ascaris: eosinophilia common

Anisakis*, *Pseudoterranova: ingestion of raw, pickled or undercooked fish or squid, white sushi; America, Hawaii, Netherlands, Scandinavia; fever, intestinal colic, abdominal abscess, eosinophilic granulomata; sometimes intestinal obstruction or perforation and peritonitis, occasionally throat infection; larvae in faeces and pharynx; biopsy

Trichinella spiralis: nausea, vomiting, diarrhoea and abdominal discomfort followed by fever, myalgias and periorbital oedema; serology; demonstration of larvae in muscle biopsy; increase in eosinophils

Toxoplasma gondii: serology

Intestinal Myiasis: usually transient; may be manifested by nausea, vomiting, intestinal discomfort and diarrhoea; arises through ingestion of food contaminated with larvae

***Human cytomegalovirus*:** barium study

Treatment:

***Cryptosporidium*:** none unless > 2 w; discontinuation of immunosuppressive drugs; oral rehydration in acute phase; antidiarrhoeal drugs; paromomycin 7.5 mg/kg to 500 mg orally 6 hourly, nitazoxanide (1-3 y: 100 mg, 4-11 y: 200 mg, > 11 y: 500 mg) orally 12 hourly for 3 d; immune bovine dialyzable leucocyte extract

Encephalitozoon intestinalis: albendazole 400 mg (≤ 10 kg: 200 mg) orally 12 hourly for 21 d (not in pregnant or < 6 mo)

Enterocytozoon bieneusi: fumagillin 60 mg orally daily for 14 d

***Cyclospora cayetanensis*:** cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 7 d in immunocompetent and 10-14 d in immunocompromised

Isospora belli: cotrimoxazole 4/20 mg/kg to 160/800 mg orally 6 hourly for 10 d, followed by 160/800 mg orally 3 times a week to prevent relapse in HIV infection

***Toxoplasma gondii*:** pyrimethamine 50-100 mg (child: 2 mg/kg to 25 mg) orally first dose then 25-50 mg daily (infants: 1 mg/kg every second or third day) for 3-6 w + sulphadiazine 1-1.5 g (child: 50 mg/kg) orally or i.v. 6 hourly for 3-4 w (clindamycin 600 mg orally or i.v. if hypersensitive) + folinic acid 3-6 mg orally daily; spiramycin 2-4 g (child: 50-100 mg/kg) orally daily for 4 w; cotrimoxazole 160/800 mg (child: 1.5/7.5 mg/kg) twice daily for 4 w

Maintenance Therapy in HIV/AIDS: pyrimethamine 25-50 mg orally daily + sulphadiazine 500 mg orally 6 hourly or 1 g orally 12 hourly (clindamycin 600 mg orally 8 hourly if hypersensitive)

Dientamoeba fragilis: doxycycline 2.5 mg/kg to 100 mg orally 12 hourly for 3-7 d (not < 8 y), metronidazole 10 mg/kg to 400 mg orally 8 hourly for 3-7 d

Giardia lamblia: tinidazole 50 mg/kg to 2 g orally as single dose, metronidazole 30 mg/kg to 2 g orally daily for 3 d

Treatment Failure: metronidazole 10 mg/kg to 400 mg orally 8 hourly for 7 d

***Blastocystis hominis*:** probably none required; metronidazole 10 mg/kg to 400 mg orally 8 hourly for 7 d, metronidazole benzoate suspension 30 mg/kg/d to maximum 1.2 g/d orally in 3 divided doses for 7 d, furazolidone 150 mg orally (not for infants < 1 mo; 1 mo - 1 y: 6.25-12.5 mg; 1-4 y: 25 mg; ≥ 5 y: 50 mg) 6 hourly for several months

Balantidium coli: tetracycline 500 mg orally 6 hourly for 10 d, metronidazole 800 mg (child: 10-15 mg/kg) orally for 5 d, paromomycin 1 g (child: 11 mg/kg) every 15 minutes for 4 doses

***Schistosoma*:** praziquantel, niridazole or sodium stibogluconate + dexamethasone

***Fasciolopsis buski*:** hexylresorcinol

***Nanophyetus salmincola*:** niclosamide 2 g orally on alternate days for 3 doses, bithionol 50 mg/kg as a single dose on alternate days for 2 doses

Other Flukes: praziquantel 25 mg/kg orally 8 hourly for 1 d, tetrachloroethylene 0.1 mL/kg to 5 mL orally

Taenia: praziquantel 10 mg/kg orally as a single dose, niclosamide 2 g (child 11-34 kg: 1 g; > 34 kg: 1.5 g) in single dose chewed thoroughly then purgative 3-4 h later, paromomycin 1 g (child: 11 mg/kg) every 15 minutes for 4 doses

Hymenolepis: praziquantel 25 mg/kg orally as a single dose, niclosamide 2 g dose chewed thoroughly daily for 7 d (child: 11-34 kg: 1 g as a single dose then 500 mg daily for 6 days; > 34 kg: 1.5 g as a single dose then 500 mg daily for 6 d), paromomycin 45 mg/kg orally daily for 7 d

***Diphyllobothrium*:** niclosamide 2 g chewed thoroughly (child 11-34 kg: 1 g; > 34 kg: 1.5 g) given once as a single dose, praziquantel 10-20 mg/kg orally as a single dose, paromomycin 1 g (child: 11 mg/kg) every 15 minutes for 4 doses

Other Tapeworms: niclosamide, dichlorophen, mepacrine

***Trichuris trichuria*:** mebendazole 100 mg (≤ 10 kg: 50 mg) twice daily orally for 3 d (not in first trimester or < 6 mo), albendazole 400 mg (≤ 10 kg: 200 mg) orally daily for 3 d (not in pregnancy, lactation or < 6 mo); precede with loperamide (initial dose 4 mg, then 2 mg after each unformed stool to maximum daily dose 16 mg) if diarrhoea

***Strongyloides stercoralis*:** ivermectin 200 μg/kg orally with fatty food (not children < 5 y) on day 1 and repeat after 7-14 d (days 1, 2, 15 and 16 in immunocompromised), albendazole 400 mg (≤ 10 kg: 200 mg) orally with fatty food once daily for 3 d and repeat after 7-14 d (not in pregnancy, lactation or < 6 mo; repeat after 1 w in complicated or disseminated infections), thiabendazole 25 mg/kg to 1.5 g orally 12 hourly for 3 d (not in first trimester or < 6 mo), mebendazole

Hookworms, *Ascaris*: pyrantel embonate 20 mg/kg to 750 mg orally as a single dose (repeat after 1 w if heavy infection), mebendazole 100 mg (≤ 10 kg: 50 mg) orally twice daily for 3 d (not in first trimester or < 6 mo), albendazole 400 mg (≤ 10 kg: 200 mg) orally as single dose (not in pregnancy, lactation or < 6 mo)

Enterobius vermicularis: pyrantel embonate 10 mg/kg to 750 mg orally single dose, mebendazole 100 mg (child ≤ 10 kg: 50 mg) orally single dose (not in first trimester or < 10 kg), albendazole 400 mg (child ≤ 10 kg: 200 mg) orally single dose (not in pregnancy, lactation or < 6 mo)

***Anisakis*, *Pseudoterranova*:** thiabendazole 25 mg/kg to maximum 3 g orally twice daily for 3 d; surgery usually required

Trichinella spiralis: mebendazole

Other Helminths: thiabendazole

Prophylaxis:

Communities with Heavy Intestinal Helminth Exposure: albendazole (≤ 10 kg: 200 mg; > 10 kg: 400 mg) orally single dose every 4-6 mo to children 6 mo-12 y

***Toxoplasma gondii* in HIV/AIDS CD4 count < 200/μL:** cotrimoxazole 80/400 or 160/800 mg orally daily or 160/800 mg orally 3 times weekly

ENTEROCOLITIS

Agents: *Campylobacter* (91% *Campylobacter jejuni,* 9% *Campylobacter fetus subsp fetus*; *Campylobacter coli* in some geographical areas; also *Campylobacter concisus, Campylobacter hyointestinalis, Campylobacter lari, Campylobacter upsaliensis, Helicobacter cinaedi, Helicobacter fennelliae;* 5% of cases of diarrhoea, 8% of infectious diarrhoea, 43% of infectious diarrhoea in adults; ≈ 13,000 notified cases/y in Australia (≈ 37% in Victoria); incidence 20/100,000 in USA (estimated 2.5 M total cases, 80% foodborne, 5% of foodborne related deaths); sporadic disease from environment (up to 50%), raw and undercooked poultry, beef and gravy, salad vegetables, bottled water; outbreaks (0.9% of foodborne related outbreaks, 0.6% of cases, 3% of deaths) from unpasteurised milk (present in 40% of dairy cattle) or juice or soft cheeses and contaminated water), *Staphylococcus aureus* (usually following tetracycline treatment), *Bacteroides*; see also **BACILLARY DYSENTERY, INFANTILE DIARRHOEA, TRAVELLERS' DIARRHOEA, BACTERIAL GASTROENTERITIS, PROCTITIS, ENTERITIS, NECROTISING ENTEROCOLITIS**; may also be due to spirochaetes and several fungi (*Candida*, *Cryptococcus neoformans*, *Paracoccidioides brasiliensis, Histoplasma capsulatum, Blastomyces dermatitidis, Sporothrix schenckii, Aspergillus, Coccidioides immitis, Mucoraceae)*

Diagnosis:

Campylobacter: cases present with clinical, sigmoidoscopic, radiographic and histologic features similar to ulcerative colitis—often bloody diarrhoea (6% of bloody diarrhoea; watery diarrhoea in 63%, macroscopic mucus in 55-87%, macroscopic blood in 7-30%, microscopic blood in 35%) and severe abdominal pain and cramps; fever in 28-90%; incubation period 2-5 d; duration of illness 2-10 d; polymorphonuclears in 96% (1-10/hpf in 56%), pH acidic in 68%; Gram stain and culture (Skirrow's medium or equivalent directly and after enrichment in medium of Martin et al microaerophilically at 42°C, mannitol salt agar aerobically at 35°C, blood agar with vancomycin and kanamycin anaerobically) of faeces

Treatment:

Campylobacter: erythromycin 10 mg/kg to 500 mg or erythromycin ethyl succinate 20 mg/kg to 800 mg orally 6 hourly for 5-7 d; norfloxacin 10 mg/kg to 400 mg orally 12 hourly for 5 d (13% require treatment, though treatment in all cases shortens symptomatic period, carriage and shedding; Guillain-Barré syndrome possible sequela)

Staphylococcus aureus: i.v. cloxacillin + oral neomycin

Bacteroides: metronidazole

NECROTISING ENTEROCOLITIS (ENTERITIS NECROTICANS, PIG-BEL): common in Papua New Guinea and China

Agent: *Clostridium perfringens C*, *Clostridium butyricum*

Diagnosis: severe abdominal pain developing up to 4 d after a protein meal, often associated with vomiting, abdominal distension and either mild diarrhoea with blood or constipation; culture of surgical specimens and typing of isolate

Treatment: surgical resection of affected length of intestine; if surgery impossible, metronidazole 500 mg (child: 7.5 mg/kg) i.v. 8 hourly or 1 g (child: 500 mg) rectally 8 hourly

NEONATAL NECROTISING ENTEROCOLITIS: 1-7.5% of neonates; significantly higher rates in infants given amoxycillin-clavulanate

Agents: *Escherichia coli*, *Klebsiella pneumoniae*

Diagnosis: clinical; X-ray (pneumotosis intestinalis); platelet count < 100,000/μL

Treatment: withdrawal of enteric feeding; oral and parenteral aminoglycoside

Prophylaxis: sodium deoxycholate

PSEUDOMEMBRANOUS COLITIS AND ANTIBIOTIC-ASSOCIATED DIARRHOEA: 10% of infective diarrhoea in adults

Agents: *Clostridium difficile* (necrotising enterocolitis, 90% of pseudomembranous colitis, 30% of antibiotic-associated diarrhoea), *Klebsiella oxytoca* (hemorrhagic colitis), *Staphylococcus aureus* (antibiotic-associated diarrhoea)

Diagnosis:

Clostridium difficile: abdominal pain, fever, nausea, vomiting, diarrhoea; feces may be blood-stained; history of antibiotic treatment (especially clindamycin and third generation cephalosporins) or antineoplastic chemotherapy; microtitre cytotoxicity toxin assay of faeces (5 d old human foreskin fibroblast or WI-38 cells; read after 4 and 24 h; sensitivity 97-100%, specificity 95%); culture of feces (sensitivity 89%, specificity 74%); counterimmunoelectrophoresis of

faeces (antiserum to toxin absorbed with cells; sensitivity 41-100%, specificity 78-100%); ELISA (Premier Toxin A and B most sensitive commercial kit); latex agglutination (sensitivity 88-91%, specificity 91-99%); flexible sigmoidoscopy

***Staphylococcus aureus*:** profuse watery diarrhoea with dehydration; feces culture

Treatment (*Clostridium difficile*): cessation of antibiotic treatment; metronidazole 10 mg/kg to 400 mg orally 8 hourly for 7-10 d

Metronidazole Intolerant: bacitracin 20,000-25,000 U orally 6 hourly for 7-10 d, fusidic acid

Unresponsive, Relapsing or Severe: vancomycin 3 mg/kg to 125 mg orally 6 hourly for 7-10 d ± *Saccharomyces boulardii*

Severely Ill with Toxic Megacolon: metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly + vancomycin 12.5 mg/kg to 500 mg orally or via nasogastric tube 6 hourly for 10 d; resection of the inflamed colon may be required

Prophylaxis: 100 g *Saccharomyces boulardii* or other probiotic drink twice daily during course of antibiotics and for 1 w after

Hemorrhagic Colitis

Agent: shigatoxin-producing *Escherichia coli* (3% of bloody diarrhoea; incidence 3/100,000 in USA (110,000 estimated total cases, 85% foodborne, 1% of foodborne related deaths; 3% of foodborne disease outbreaks, with 4% of cases and 28% of deaths; undercooked meat (ground beef) or poultry, unpasteurised milk or juice, unpasteurised soft cheeses, unchlorinated water supplies, animal contact at petting zoo, farm animal hides; most sporadic cases from environment); mainly serotype O157:H7; cases due to O111:H8 in Australia; also O173:H55 and O166); may lead to development of hemolytic uremic syndrome or thrombotic thrombocytopenic purpura, particularly in children < 15 y and adults > 65 y (hypochlorhydria and coincidental antibiotics significant risk factors)

Diagnosis: severe, often bloody, diarrhoea, abdominal pain and vomiting following ingestion of undercooked beef, unpasteurised milk or juice, raw fruits and vegetables, salami, salad dressing, contaminated water; incubation period 1-8 d; duration of illness 5-10 d; fever in ≈ 1/3 cases, more common in < 4 y; culture of feces on sorbitol MacConkey agar or Rainbow Agar VTEC + serotyping of isolate; toxin assay (false positives)

Differential Diagnosis: inflammatory bowel disease, polyps, Meckel's diverticulum, intussusception, coagulopathy, infectious enteritis

Treatment: supportive; monitor renal function, hemoglobin and platelets closely; antibiotics may be harmful (though recent research suggests azithromycin may be beneficial)

Typhlitis: necrotising colitis in neutropenics, especially children with acute leukemia

Agents: *Escherichia coli, Enterobacter cancerogenus, Morganella morganii, Pseudomonas aeruginosa, Clostridium,* other Gram negative bacilli

Diagnosis: temperature ≥ 38.5°C in all, diarrhoea in 92% (bloody in 54%), nausea in 75%, vomiting in 67%, decreased bowel sounds in 62%, rebound/guarding in 58%, abdominal distension in 54%; computed tomography and ultrasonography of pelvis show pathognomonic bowel thickening; may progress to perforation, peritonitis, fistulous communications and sepsis; potentially lethal

Treatment: surgical excision if clinical deterioration; appropriate antibiotics

Cytomegaloviral Colitis

Agent: *human cytomegalovirus*

Diagnosis: barium enema; IgG seroconversion; viral culture

Treatment: valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly or 180 mg/kg/d by continuous i.v. infusion for 2 w then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria ≤ 2+ and creatinine clearance ≥ 55 mL/min) then as above every 2 w

Gastrointestinal Anthrax (Mycosis Intestinalis; Splenic Fever in Animals): form of anthrax acquired by man through consumption of contaminated raw or undercooked meat or by dissemination from pulmonary or cutaneous forms; no cases in USA; considered rare but probably greatly underreported in rural endemic areas (Thailand, India, Iran, Gambia, Uganda); case-fatality rate 25-60%

Agent: *Bacillus anthracis*

Diagnosis: oropharyngeal anthrax: fever and toxemia, inflammatory lesions in oral cavity or oropharynx, enlargement of cervical lymph nodes, edema of soft tissue of cervical area; lower areas: abdominal distress characterised by nausea, vomiting, anorexia, fever and malaise followed by abdominal pain, hematemesis, fever and, sometimes, bloody diarrhoea;

incubation period 2 d to weeks; duration of illness weeks; Gram stain and culture of stools; blood cultures; ELISA, Western blot, toxin detection, chromatographic assay, fluorescent antibody test

Treatment: procaine penicillin 600 000 U 12 hourly i.m. (child: 25 000-30 000 U/kg daily in 2 divided doses) for 5-7 d, ciprofloxacin, tetracycline 500 mg orally 4 hourly for 5 days, erythromycin 500 mg orally 6 hourly (child: 30 mg/kg/d in 4 divided doses) for 5 d

PROCTITIS

Agents: *Neisseria gonorrhoeae* (anorectal gonococcal disease of the rectal columnar mucosa arising either by direct extension from a urogenital process (in female) or as the result of primary infection; frequently inapparent but may give rise to severe proctitis), *Simplexvirus*, *Chlamydia trachomatis* (LGV), *Treponema pallidum*, single cases due to *Neisseria cinerea* (in 8 year old boy) and *Plesiomonas shigelloides* (with fatal septicemia); also non-specific proctitis (analogous to ulcerative colitis)

Diagnosis: Gram stain and bacterial and viral culture of pus; immunofluorescence; biopsy; CT scan

Treatment:

***Neisseria gonorrhoeae*:** ceftriaxone 125 mg i.m. + doxycycline 100 mg orally twice a day for 7 d

***Treponema pallidum*:** penicillin + probenecid

***Chlamydia trachomatis*:** tetracycline, doxycycline, erythromycin

***Simplexvirus*:** famciclovir 500 mg orally 12 hourly for 7-10 d, valaciclovir 500 mg orally 12 hourly for 7-10 d, aciclovir 200 mg orally 5 times daily for 7-10 d

Frequent, Severe Recurrences: famiclovir 500 mg orally 12 hourly, valaciclovir 500 mg orally 12 hourly, aciclovir 200 mg orally 8 hourly or 400 mg orally 12 hourly

Non-specific: prednisolone suppositories

PROCTOCOLITIS

Agents: *Campylobacter jejuni*, *Campylobacter hyointestinalis, Helicobacter cinaedi* and *Helicobacter fennelliae* (homosexual men), *Shigella, Entamoeba histolytica, Chlamydia trachomatis* (LGV; rare), *human cytomegalovirus* in AIDS

Diagnosis: wet mount, Gram stain and culture of pus

Treatment:

***Campylobacter, Helicobacter*:** erythromycin

***Human cytomegalovirus*:** valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2-3 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly for 2-3 w then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria $\leq$ 2+ and creatinine clearance $\geq$ 55 mL/min) then as above every 2 w

Shigella: ceftriaxone 125 mg i.m. for 7 d

***Chlamydia trachomatis*:** tetracycline, doxycycline, erythromycin

Entamoeba histolytica: metronidazole

ACUTE ABDOMEN SYNDROMES

Agents: infectious causes include (in order of frequency) acute appendicitis, diverticulitis of colon, acute tonsillitis (in young children), pneumonia, herpes zoster (T8-12), Bornholm disease, intestinal worms, acute hemolytic crisis in malaria

Diagnosis: examination of patient; X-rays of chest and abdomen; blood, urine and feces examination

Treatment: dependent on cause

ABDOMINAL CRAMPS are very severe in staphylococcal food poisoning, severe in 98% of cases of *Salmonella* gastroenteritis, 95% of *Shigella* infections and 84% of *Campylobacter* enteritis, and moderate in 67% of cases of cryptosporidiosis. Abdominal cramps also occur in 92% of *Vibrio parahaemolyticus* and 87% of enterotoxigenic *Escherichia coli* infections, in 82% of cases of traveller's diarrhoea, 79-86% of *Norwalk virus* gastroenteritis, 74% of *Clostridium perfringens* food poisoning, 63% of *Aeromonas hydrophila* infections, 59% of cholera cases, and 25% of trichinosis, as well as in other cases of acute infectious nonbacterial gastroenteritis, in food poisoning due to *Salmonella enteric subsp enteric serovar Arizona*, *Bacillus cereus*, *Enterobacteriaceae, Pseudomonas aeruginosa, Enterococcus faecalis, Enterococcus faecium* and *Yersinia enterocolitica*, in botulism, diphyllobothriasis, giardiasis, psittacosis, tick paralysis, *Vibrio cholerae* non-01 infections and chemical poisoning.

ABDOMINAL DISCOMFORT of lesser degree is also seen in 22% of hospitalised measles cases, intermittently in rabies, and in echinococcosis and wound botulism.

ABDOMINAL DISTENSION is a feature of 66% of cases of typhoid fever, 14% of peritonitis, 6% of amoebic liver abscess, and also occurs in diphyllobothriasis, giardiasis and necrotising enterocolitis.

Abdominal Guarding is prominent in 23% of cases of amoebic liver abscess and 18% of peritonitis.
Abdominal Mass is found in 17% of cases of pyogenic liver abscess, in 10% of amoebic liver abscess, and in echinococcosis (non-tender).
Abdominal Rigidity is associated with chromobacteriosis and spider bite (*Latrodectus mactans* et al)
Abdominal Symptoms also occur in legionellosis.
Colic is particularly associated with ascariasis and (in severe form) shigellosis.
Crohn's Disease: found more often in children than in adults
Agent: ? *Mycobacterium avium subsp paratuberculosis*
Diagnosis: fever, abdominal pain, diarrhoea, weight loss, often resembling acute appendicitis; failure to isolate causative organism; macroscopic appearance of gut (involvement of terminal ileum, often with extensions to proximal colon; crypt abscesses and microgranulomas) when abdomen opened for suspected appendicitis
Appendicitis
Agents: coliforms, mixed anaerobes, *Streptococcus pyogenes*, *Streptococcus viridans,* staphylococci, *Arcobacter butzleri, Campylobacter jejuni, Aggregatibacter segnis, Streptococcus milleri, Enterobius vermicularis, Entamoeba histolytica, Taenia saginata, Angiostrongylus costaricensis, Ascaris lumbricoides, Trichuris trichuria, Schistosoma mansoni, Strongyloides stercoralis, Cryptosporidium, Balantidium coli* (exceedingly rare)
Diagnosis: usually based on clinical symptoms + neutrophilia (96% of cases > 10,000 leucocytes/μL or > 75% neutrophils) and absence of other infection such as UTI; barium enema, laparoscopy, sonography; *Enterobius vermicularis*, a rare cause, produces eosinophilia as well as neutrophilia; cultures of swabs taken at surgery may be performed to confirm diagnosis and to provide the basis for therapy if peritonitis should develop

Amoebic Appendicitis: diarrhoea with blood-stained stools

***Angiostrongylus costaricensis*:** intraabdominal mass, usually localised in right iliac fossa; in most cases, lesions localised in appendix but, at times, they may reach terminal portion of ileum, cecum and colon; abdominal pain, anorexia, vomiting and fever that may persist for 2 mo; abdomen distended; marked leucocytosis with eosinophilia of 11-81% may be present

Treatment: surgery after 1 d ceftizoxime
Diverticulitis
Agents: anaerobes (*Bifidobacterium, Eubacterium*), enterics
Diagnosis: radiology; culture not necessary
Treatment: dietary restriction; fluids (oral or i.v.); surgery if necessary; if perforation, treat as for **Peritonitis;** amoxycillin/clavulanate 875/125 mg orally 12 hourly for 5-10 d; metronidazole 400 mg orally 12 hourly + cephalexin 500 mg orally 6 hourly for 5-10 d

Immediate Penicillin Hypersensitive: metronidazole 400 mg orally 12 hourly + cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 5-10 d

Prophylaxis: psyllium hydrophilic mucilloid
Biliary Cirrhosis
Agents: *Clonorchis sinensis*, *Fasciola gigantica, Fasciola hepatica, Opisthorchis viverrini* (Thailand and Laos), *Opisthorchis felineus* (Eastern Europe)
Diagnosis: geographic history; dietary history; ova in stools, biliary drainage, duodenal drainage; indirect hemagglutination, counterimmunoelectrophoresis, complement fixation test; anti-mitochondrial antibody test +++

Fasciola: fever, pain in epigastrium or right hypochondrium, anorexia, nausea, vomiting, sometimes alternating diarrhoea and constipation, hepatomegaly, biliary colic; occasionally halzoun; often eosinophilia; may be asymptomatic

***Clonorchis sinensis*, *Opisthorchis*:** fever, abdominal pain, jaundice
Treatment: bithionol 30-50 mg/kg orally on alternate days for 20-30 d (only treatment for *Fasciola*), praziquantel 25 mg/kg orally 8 hourly for 5-8 d, metronidazole 1.5 g orally in divided doses daily
Cholecystitis
Agents: 58% *Escherichia coli*, 34% *Enterococcus faecalis*, 23% *Enterobacter,* 19% *Clostridium perfringens* (emphysematous in older diabetic males), 14% *Klebsiella oxytoca,* 11% *Klebsiella pneumoniae,* 9% α-hemolytic streptococci; other streptococci (including *Streptococcus milleri*), staphylococci, other coliforms, anaerobes; rarely, *Pseudomonas*, *Campylobacter*, *Achromobacter xylosoxidans*, *Vibrio metschnikovii, Plesiomonas shigelloides*, *Haemophilus aprophilus*, *Desulphovibrio desulfuricans, Listeria monocytogenes, Ascaris lumbricoides*, *Clonorchis sinensis*, *Opisthorchis felineus*, *Opisthorchis viverrini*, *Cryptosporidium*, *Taenia saginata*; *human cytomegalovirus* and *Candida* in AIDS
Diagnosis: clinical; radiographic; culture of bile and other surgical specimens

Treatment: cholecystectomy +

***Pseudomonas*:** gentamicin

***Campylobacter*:** erythromycin

Other Bacteria: amoxy(ampi)cillin 25 mg/kg to 1 g i.v. 6 hourly + gentamicin 4-6 mg/kg i.v. as single daily dose (penicillin hypersensitive or gentamicin contraindicated: ceftriaxone 25 mg/kg to 1 g i.v. once daily or cefotaxime 25 mg/kg to 1 g i.v. 8 hourly) + metronidazole 400 mg orally 2 hourly if biliary obstruction till afebrile; follow with amoxycillin-clavulanate 500 mg orally 8 hourly if required till afebrile 48 h and normal neutrophil count

***Clonorchis sinensis*, *Opisthorchis*:** praziquantel 25 mg/kg orally 8 hourly for 1 d, chloroquine phosphate 600 mg base orally daily for 6 w

Other Helminths: praziquantel, thiabendazole

ASCENDING CHOLANGITIS

Agents: *Escherichia coli, Enterobacter, Klebsiella, Pseudomonas,* anaerobes

Diagnosis: right upper quadrant pain, fluctuating jaundice, swinging pyrexia, rigors, leucocytosis, raised serum albumin and alkaline phosphatase, bacteremia

Treatment: relief of biliary obstruction; amoxy/ampicillin 50 mg/kg to 2 g i.v. 6 hourly + gentamicin 4-6 mg/kg (child < 10 y: 7.5 mg/kg; ≥ 10 y: 6 mg/kg) i.v. daily for up to 3 d (adjust dose for renal function) + metronidazole 12.5 mg/kg to 500 mg i.v. if previous biliary tract surgery or known biliary obstruction, then (when afebrile) amoxycillin + clavulanate 22.5 + 3.2 mg/kg to 875 + 125 mg orally 12 hourly for total of 7 d

Penicillin Hypersensitive or Gentamicin Contraindicated: ceftriaxone 25 mg/kg to 1 g i.v. daily, cefotaxime 25 mg/kg to 1 g i.v. 8 hourly

Lack of Response to 3 d i.v. Therapy: piperacillin + tazobactam 100 + 12.5 mg/kg to 4 + 0.5 g i.v. 8 hourly, ticarcillin + clavulanate 50 + 1.7 mg/kg to 3 + 0.1 g i.v. 6 hourly

PANCREATITIS

Agents: *mumps virus*, coxsackievirus B (may result in diabetes), coliforms (usually complicating chronic non-infectious cases), *human cytomegalovirus* (59% of cases in AIDS), adenovirus, *Cryptococcus neoformans* (18% of cases in AIDS), *Mycobacterium avium-intracellulare* (14% of cases in AIDS), *Toxoplasma gondii* (7% of cases in AIDS), *Mycobacterium tuberculosis* (uncommon), *Ascaris lumbricoides*; also gallstones, alcohol, medicines (2-5%)

Diagnosis: serology; viral culture of saliva; histology and culture of biopsy; check for abscess formation; serum aldolase inconsistently increased, serum amylase increased, serum leucine aminopeptidase inconsistently increased, serum lipase increased; endoscopic retrograde cholangiopancreatography

Treatment:

***Human cytomegalovirus*:** valganciclovir 900 mg orally 12 hourly for 14-21 d then 900 mg orally daily, ganciclovir 5 mg/kg i.v. twice a day for 2-3 w then 10 mg/kg i.v. 3 times a week or 5 mg/kg i.v. 5 times a week during continued immunosuppression, foscarnet 90 mg/kg i.v. 12 hourly for 2-3 w then 90-120 mg/kg i.v. 5 times weekly, cidofovir 5 mg/kg i.v. weekly for 2 w (+ probenecid if proteinuria ≤ 2+ and creatinine clearance ≥ 55 mL/min) then as above every 2 w

Other Viral: non-specific

Coliforms: amoxycillin-clavulanate

***Cryptococcus neoformans*:**

Mild: fluconazole 800 mg orally or i.v. initially, then 400 mg daily for 10 w

More Severe: amphotericin B desoxycholate 0.7 mg/kg i.v. daily for 2-4 w ± flucytosine 25 mg/kg i.v. or orally 6 hourly for 2-4 w; if clinical improvement after 2 w, change to fluconazole 800 mg orally initially then 400 mg daily for 8 w

Secondary Prophylaxis in HIV Infection: fluconazole 200 mg orally daily or itraconazole 200 mg orally daily

***Mycobacterium avium-intracellulare*:** ethambutol 15 mg/kg orally daily (not < 6 y) + clarithromycin 12.5 mg/kg to 500 mg orally 12 hourly or azithromycin 10 mg/kg to 500 mg orally daily + rifampicin 10 mg/kg to 600 mg orally daily or rifabutin 5 mg/kg to 300 mg orally daily

***Toxoplasma gondii*:** pyrimethamine 50-100 mg (child: 2 mg/kg to 25 mg) orally first dose then 25-50 mg daily (infants: 1 mg/kg every second or third day) for 3-6 w + sulphadiazine 1-1.5 g (child: 50 mg/kg) orally or i.v. 6 hourly for 3-4 w (clindamycin 600 mg orally or i.v. if hypersensitive) + folinic acid 3-6 mg orally daily; spiramycin 2-4 g (child: 50-100 mg/kg) orally daily for 4 w; cotrimoxazole 160/800 mg (child: 1.5/7.5 mg/kg) twice daily for 4 w

Maintenance Therapy in HIV/AIDS: pyrimethamine 25-50 mg orally daily + suphadiazine 500 mg orally 6 hourly or 1 g orally 12 hourly (clindamycin 600 mg orally 8 hourly if hypersensitive)

Severe Necrotising: meropenem 500 mg i.v. 8 hourly for 7 d, imipenem 500 mg i.v. 6 hourly for 7 d, piperacillin + tazobactam 4 + 0.5 g i.v. 8 hourly for 7 d

Ascaris lumbricoides: mebendazole, albendazole

Prophylaxis:

***Mycobacterium avium* Complex in HIV/AIDS (CD4 cell count < 50/μL):** azithromycin 1.2 g orally weekly, clarithromycin 500 mg orally 12 hourly, rifabutin 300 mg orally daily

***Toxoplasma gondii* in HIV/AIDS (CD4 Count < 200/μL):** cotrimoxazole 80/400 or 160/800 mg orally daily or 160/800 mg orally 3 times weekly

Pancreatic Abscess: 3-4% of acute pancreatitis cases; mortality ≈ 100% untreated, ≈ 40% treated

Agents: *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Salmonella typhi,* coliforms, *Haemophilus influenzae*, *Eikenella corrodens*, *Ochrobactrum anthropi*, *Plesiomonas shigelloides* (1 case postoperative), *Candida albicans* (very rare)

Diagnosis: ultrasound; Gram stain, Grocott-Gomori methenamine-silver stain and culture of aspirate

Treatment:

Bacteria: surgery + amoxycillin-clavulanate

***Candida albicans*:** drainage + amphotericin B