

Chapter 8

Wound and Soft Tissue Infections, Local and Generalised Sepsis

HUMAN BITE AND CLENCHED FIST INFECTIONS: human bites 2-23% of all bite wounds; 15-20% on head and neck

Agents: *Fusobacterium*, β -lactamase-producing anaerobes, *Eikenella corrodens*, *Enterobacter*, *Klebsiella*, *Streptococcus*, diphtheroids, *Neisseria*, coagulase negative *Staphylococcus*, *Pseudomonas*, *Proteus*, *Escherichia coli*, *Staphylococcus aureus*, *Haemophilus influenzae*

Diagnosis: culture of wound swab

Treatment: forced pulsatile irrigation of wound, debridement, scrubbing with 1% povidone iodine; elevation; immobilisation; do not suture or surgically close wound before 24 h post injury; procaine penicillin 50 mg/kg to 1.5 g i.m. as single dose, then amoxycillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally 12 hourly for 5 d; assess tetanus immune status and administer tetanus toxoid if no history of 3 or more doses of toxoid in previous 5 y, and tetanus immunoglobulin if uncertain vaccination history or < 3 doses of toxoid

Established Infection: metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5-10 d + ceftriaxone 25 mg/kg to 1 g i.v. daily for 5-10 d or cefotaxime 25 mg/kg to 1 g i.v. 8 hourly for 5-10 d; piperacillin-tazobactam 100/12.5 mg to 4/0.5 g i.v. 8 hourly for 5-10 d; ticarcillin-clavulanate 50/1.7 mg/kg to 3/0.1 g i.v. 6 hourly for 5-10 d

Penicillin Hypersensitive: metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5-10 d + doxycycline 5 mg/kg to 200 mg first dose then 2.5 mg/kg to 100 mg orally daily for 5-10 days (not < 8 y, pregnant or breastfeeding) or cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 5-10 d or ciprofloxacin 10 mg/kg to 500 mg orally 12 hourly for 5-10 d

CAT AND DOG BITE INFECTIONS

Agents: *Pasteurella multocida* (> 50% of cat bites, 15-30% of dog bites), *Staphylococcus aureus* (20-30% of dog bites), other *Pasteurella* species, *Capnocytophaga canimorsus*, *Capnocytophaga cynodegmi*, *Streptomyces sp EF-4*, *Streptomyces coelicolor*, *Actinobacillus actinomycetemcomitans*, *Haemophilus arophilus*, *Staphylococcus intermedius* and other coagulase negative *Staphylococcus*, *Streptococcus* (α , β and γ), *Micrococcus*, *Actinomyces*, *Fusobacterium*, *Peptostreptococcus*, *Eubacterium*, *Veillonella parvula*, *Leptotrichia buccalis*, rarely Gram negative enteric bacilli, *Pseudomonas fluorescens*, *Francisella tularensis*, CDC Group NO-1

Diagnosis: culture of wound swab

Treatment: as for **HUMAN BITE AND CLENCHED FIST INFECTIONS**, but suture or delayed primary closure may be performed

FISH SPINE INJURY AND OTHER WATER-RELATED INFECTIONS

Agents: *Vibrio* species (especially *Vibrio vulnificus*, *Vibrio alginolyticus*, rapidly developing life-threatening infection may occur in cirrhosis or iron overload), *Shewanella putrefaciens* (salt or brackish water), *Aeromonas hydrophila* (fresh or brackish water; high risk of fulminant infection in hepatic disease, chronic illness, immunocompromised), *Edwardsiella tarda* (similar to *Aeromonas*), *Pseudomonas* species, *Klebsiella*, *Escherichia*, *Staphylococcus* species, *Streptococcus pyogenes* (often associated with coral cuts), *Mycobacterium marinum* (fish tanks)

Diagnosis: swab culture

Treatment: irrigation, exploration; tetracycline + broad spectrum β -lactamase-stable β -lactam or narrow spectrum β -lactamase-stable penicillin + gentamicin

Vibrio: incision, drainage, debridement; doxycycline 5 mg/kg to 200 mg orally or i.v. twice daily then 2.5 mg/kg to 100 mg orally or i.v. 12 hourly (not < 8 y); ceftazidime 2 g i.v. 3 times a day; cefotaxime; ceftriaxone; ciprofloxacin

400 mg twice a day for 3 d, minocycline

Aeromonas hydrophila, Edwardsiella tarda: ciprofloxacin 10 mg/kg to 400 mg i.v. or 10 mg/kg to 500 mg orally 12 hourly

Streptococcus pyogenes: phenoxymethylpenicillin 500 mg orally 6 hourly

BURN INFECTIONS

Agents: *Pseudomonas aeruginosa* (only in burns affecting \geq 50% of total body surface and involving destruction of cutaneous structures), *Staphylococcus aureus*, *Acinetobacter*, *Flavobacterium meningosepticum*, other bacteria, *Aspergillus*, all isolates should be considered of possible significance

Diagnosis: Gram stain, quantitative culture ($> 10^5$ /g = sepsis) and histology of biopsy

Treatment: early and frequent debridement of necrotic tissue

Flavobacterium meningosepticum: ciprofloxacin, clindamycin

Pseudomonas aeruginosa: mafenide; parenteral aminoglycoside + β -lactam if frank infection

Other Bacteria: gentamicin; topical povidone iodine; nonsteroidal antiinflammatory drugs

Aspergillus: i.v. amphotericin B; radical debridement/amputation essential for management

SURGICAL PROPHYLAXIS: The most important single factor in preventing infection is the surgeon's technique. Others are short preoperative hospital stay; preoperative bathing and showering with antibacterial soap; no shaving or shaving to take place immediately before operation; reduction of risk factors such as obesity, diabetes, malnutrition; spraying of wounds with povidone iodine; postoperative vitamin C. Nasal application of mupirocin in *Staphylococcus aureus* carriers may reduce risk of nosocomial infection. Risk factors for surgical wound infection include prolonged preoperative stay, old age, morbid obesity, infection at other sites, ASA class, disease severity index, immunosuppression, razor shave, low abdominal incision, no prophylactic antibiotics, specific procedure, intraoperative contamination, prolonged duration of surgery, surgical wound class; probably malnutrition, low albumin, prolonged admission, tissue trauma, multiple procedures; possibly cancer, diabetes mellitus, inexperienced surgeon, low procedure volume, number of people in operating room, emergency surgery, no preoperative scrub, failure to obliterate dead space, poor hemostasis, foreign material, glove puncture, drains. Antibiotics should be administered systemically at start of anesthesia and, except where indicated, when skin sutures are being inserted.

Insertion of Synthetic Biomaterial Device or Prosthesis, Clean Operations in Patients with Impaired Host Defences (Likely Pathogens *Staphylococcus aureus*, Coagulase Negative

***Staphylococcus*, *Escherichia coli*):** cefazolin 1 g i.v. or cefuroxime 750 mg i.v. 30 mins before skin incision, second dose if procedure > 3 h

Clean Wounds (Elective, Primarily Closed, No Acute Inflammation or Transection of Genitourinary, Oropharyngeal, Gastrointestinal, Biliary or Tracheobronchial Tracts; No Technique Breaks): exogenous infection, especially *Staphylococcus*, infection rate < 2%

Cardiac Surgery (Valve Replacement, Coronary Artery Bypass Surgery, Cardiac Transplant, Insertion of Permanent Pacemaker), Peripheral Vascular Procedures, Arterial Reconstructive Surgery of Abdominal Aorta or Lower Limb (Likely Pathogens *Staphylococcus aureus*, Coagulase Negative *Staphylococcus*, Diphtheroids, Aerobic Gram Negative Bacilli), Breast (Likely Pathogen *Staphylococcus aureus*), Dialysis Access (Likely Pathogens Coagulase Negative *Staphylococcus*, *Staphylococcus aureus*): cephalothin 50 mg/kg to 2 g i.v. at time of induction (continue 6 hourly for 48 h for arterial reconstructive surgery involving abdominal aorta or lower limb); cephalosporin 25 mg/kg to 1 g (\geq 80 kg: 2 g) i.v. at time of induction (continue 8 hourly for 48 h for arterial reconstructive surgery involving abdominal aorta or lower limb); gentamicin 2 mg/kg i.v. at time of induction (continue 6 hourly for 48 h for arterial reconstructive surgery involving abdominal aorta or lower limb) + di(fl)cloxacillin 50 mg/kg to 2 g i.v. at time of induction (continue 6 hourly for 48 h for arterial reconstructive surgery involving abdominal aorta or lower limb); vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1.5 g i.v. over at least 1 h, ending infusion just prior to induction + gentamicin 2 mg/kg i.v. at time of induction

Orthopedic (Prosthetic Large Joint Replacement, Insertion of Prosthetic or Transplant Material, Internal Fixation of Fractures of Large Bones): likely pathogens *Staphylococcus aureus*, coagulase negative *Staphylococcus*, diphtheroids, aerobic and anaerobic Gram negative bacilli; cephalothin 50 mg/kg to 2 g i.v. at time of induction, or cephalosporin 25 mg/kg to 1 g (\geq 80 kg: 2 g) i.v. at time of induction

Craniotomy (Prolonged Procedures, Reexplorations, Microsurgery, Insertion of Prosthetic Material), Clean Head and Neck Surgery (Skin Excision, Neck Dissections): likely pathogens coagulase negative *Staphylococcus*, *Staphylococcus aureus*, diphtheroids, less commonly aerobic Gram negative bacilli and anaerobes; di(fl)cloxacillin 50 mg/kg to 2 g i.v. at time of induction, cephalothin 50 mg/kg to 2 g i.v. at time of induction, cephalosporin 25 mg/kg to 1 g (\geq 80 kg: 2 g) i.v. at time of induction; vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1.5 g i.v. by slow infusion ending just before procedure if MRSA known or suspected or penicillin hypersensitive

Clean-contaminated Wounds (Urgent or Emergency Case That is Otherwise 'Clean'; Elective, Controlled Opening of Gastrointestinal, Oropharyngeal, Biliary or Tracheobronchial Tract; Minimal Spillage and/or Minor Technique Break; Reoperation Through 'Clean' Incision Within 7 d; Blunt Trauma, Intact Skin; Negative Exploration): endogenous bacteria > 10^6 /g of tissue; infection rate 5-10%

Head, Neck (Including Ear, Nose, Throat and Dental Procedures, Laryngectomy and Other Head and Neck Cancer Operations) and Thoracic Surgery: likely pathogens mixed aerobic and anaerobic upper respiratory flora, *Staphylococcus aureus*; cephalothin 50 mg/kg to 2 g or cephazolin 25 mg/kg to 1 g (≥ 80 kg: 2 g) at time of induction

Mandibular Fractures (Likely Pathogens Oral Flora): penicillin 2 MU (4 MU if > 60 kg) i.v. 30 mins before skin incision

Colorectal, Appendicectomy, Upper Gastrointestinal Tract, Biliary Surgery, Laparoscopic Surgery (All Persons): likely pathogens anaerobic streptococci, *Enterococcus faecalis*, enteric aerobic and anaerobic Gram negative bacilli, clostridia; 10% mannitol clearance; metronidazole 1 g rectally 2-4 h before surgery or 12.5 mg/kg to 500 mg i.v. ending infusion at time of induction (omit for patients with normal gastric acid and motility, no obstruction, no bleeding and no malignancy or previous gastric surgery undergoing upper gastrointestinal surgery and for patients < 60 y and non-diabetic undergoing biliary tract surgery and for elective cholecystectomy with low risk of exploration of common bile duct) + cephalothin 50 mg/kg to 2 g or cephazolin 25 mg/kg to 1 g (≥ 80 kg: 2 g) i.v. or gentamicin 2 mg/kg i.v. at time of induction; cefoxitin 40 mg/kg to 2 g i.v. at time of induction as single drug

Endoscopic Procedures Involving Biliary Tract, Sclerotherapy, Esophageal Dilation, Endoscopic Retrograde Cholangiopancreatography, Percutaneous Endoscopic Gastrostomy, Jejunostomy Tube Insertion: cephalothin 50 mg/kg to 2 g i.v. at time of induction or cephazolin 25 mg/kg to 1 g (≥ 80 kg: 2 g) i.v. or gentamicin 2 mg/kg i.v. at time of induction; if endoscopic retrograde cholangiopancreatography and biliary stasis, + amoxicillin + clavulanate 22.5 + 3.2 mg/kg to 875 + 125 mg orally 12 hourly for 3 d

Beta-lactam Allergy or MRSA Colonisation: vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1.5 g i.v. by slow infusion ending just before the procedure

Hernia Repair with Prosthetic Material: cephalothin 50 mg/kg to 2 g i.v. at time of induction, cephazolin 25 mg/kg to 1 g (≥ 80 kg: 2 g) i.v. at time of induction

Hysterectomy, Termination of Pregnancy (All Women): screen for vaginosis and *Chlamydia trachomatis* and treat before operation; otherwise, likely pathogens anaerobic bacteria, enteric Gram negative bacilli, *Streptococcus*, *Enterococcus*; tinidazole 2 g orally 6-12 h prior to surgery or metronidazole 500 mg i.v. ending infusion at time of induction + cephalothin 2 g i.v. at time of induction or cephazolin 1 g i.v. at time of induction (doxycycline 100 mg i.v. if β -lactam allergy) or cefoxitin 40 mg/kg to 2 g i.v. at time of induction

Caesarean Section: likely pathogens anaerobic bacteria, *Enterococcus faecalis*, aerobic Gram negative bacilli, streptococci; cephalothin 2 g i.v. or cephazolin 1 g (≥ 80 kg: 2 g) i.v. immediately after clamping cord; β -lactam allergy: clindamycin 900 mg i.v. + gentamicin 1.5 mg/kg i.v. at time of cord clamping

Urinary Tract Surgery: likely pathogens *Enterococcus faecalis*, enteric Gram negative bacilli; not needed for patients with sterile urine; patients with urinary tract infection should be treated preoperatively on basis of culture and susceptibility results; if this is not possible, gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. single dose (adjust dose for renal function)

Renal Transplantation: likely pathogens *Staphylococcus*, *Streptococcus*, enteric Gram negative bacilli; cephalothin 2 g or cephazolin 1 g i.v. or cefuroxime 750 mg i.v. at time of induction

Liver Transplantation: likely pathogens *Staphylococcus*, *Streptococcus*, enteric Gram negative bacilli, *Enterococcus*; cephalothin 2 g or cephazolin 1 g i.v. at time of induction + metronidazole 500 mg i.v. at time of induction; cefotetan 2g or cefoxitin 2 g i.v. at time of induction; ampicillin-sulbactam 3 g i.v. 30 mins before skin incision (second dose if procedure > 3 h)

Pancreas or Pancreas/Kidney Transplantation: likely pathogens coagulase negative staphylococci, *Enterococcus*, yeasts; ampicillin-sulbactam 3 g i.v. + fluconazole 400 mg i.v. 30 mins before skin incision

Lower Limb Amputation Surgery: likely pathogen *Clostridium perfringens*; benzylpenicillin 30 mg/kg to 1.2 g i.v. at time of induction then 6 hourly for 24 h, metronidazole 1 g rectally commencing 2-4 h before surgery or 12.5 mg/kg to 500 mg i.v. ending at time of induction then 12 hourly for 24 h; iodine skin antiseptics

Prostatectomy: likely pathogens coliforms, staphylococci, *Pseudomonas*; gentamicin 2 mg/kg i.v. as a single dose at time of induction

Transrectal Prostatic Biopsy: trimethoprim 300 mg orally as single dose 1 h before procedure

Arterial Reconstructive Surgery Involving Abdominal Aorta and/or Lower Limb, Especially if Groin Incision Or Implantation of Foreign Material: cephalothin 50 mg/kg to 2 g i.v. at time of induction and then 6 hourly for 48 h, cephazolin 25 mg/kg to 1 g (≥ 80 kg: 2 g) i.v. at time of induction and then 6 hourly for 48 h, di/flucloxacillin 50 mg/kg to 2 g i.v. at time of induction and then 6 hourly for 48 h + gentamicin 4-6 mg/kg (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg) i.v. at time of induction and 24 h later (adjust dose for renal function)

Known or Suspected MRSA or Penicillin Hypersensitive: vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1.5 g i.v. by slow infusion ending just before procedure + gentamicin 4-6 mg/kg (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg) i.v. at time of induction and 24 h later (adjust dose for renal function)

Contaminated Wounds (Acute Non-purulent Inflammation; Major Technique Break or Major Spill from Hollow Organ; Penetrating Trauma < 4 h Old; Chronic Open Wounds to be Grafted or Covered): as for **Clean-contaminated Wounds**, but infection rate 12-20%

Dirty Wounds (Purulence or Abscess; Preoperative Perforation of Gastrointestinal, Oropharyngeal, Biliary or Tracheobronchial Tracts; Penetrating Trauma > 4 h Old): primary pathogen, endogenous organisms; surgical technique most important; delayed primary closure reduces infection rate from 50% to 0%

Ruptured, Perforated or Gangrenous Viscus: likely pathogens anaerobic bacteria, *Enterococcus faecalis*, aerobic Gram negative bacilli; tetracycline lavage; metronidazole 500 mg i.v. 8 hourly + amoxicillin 2 g 4 hourly + gentamicin 1.3 mg/kg 8 hourly

Fungal Prophylaxis in Critical Surgical Patients (≥ 3 d in Surgical ICU): fluconazole 400 mg/d

Burns (Extensive Skin Loss): likely pathogens *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa*, enteric Gram negative bacilli; silver sulphadiazine 1% with chlorhexidine gluconate 0.2% cream topically at each dressing change

Ophthalmic Surgery: likely pathogens *Staphylococcus aureus*, coagulase negative *Staphylococcus*, *Streptococcus viridans*, gentamicin or chloramphenicol eye drops or ointment for 1-2 d only

MUSCULAR, SKELETAL AND SOFT TISSUE TRAUMA, CRUSH INJURIES AND STAB WOUNDS

Agents: *Staphylococcus aureus*, *Streptococcus pyogenes*, *Clostridium perfringens*, aerobic Gram negative bacilli

Diagnosis: swab or tissue culture

Treatment: careful cleaning, debridement, immobilisation, elevation; tetanus toxoid if uncertain vaccination history, < 3 doses of tetanus toxoid, > 10 y since vaccination or 5-10 y and dirty or major wound; tetanus immunoglobulin if uncertain vaccination history or < 3 doses of tetanus toxoid and dirty or major wound

Hospitalisation Not Required: di(flucloxacillin 12.5-25 mg/kg to 500 mg orally 6 hourly for 5-7 d + metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5-7 d

Hospitalisation Required: di(flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly + gentamicin 5-7 mg/kg i.v. as single daily dose (child: 7.5 mg/kg/d i.v. in 1-3 divided doses)+ metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly for at least 5 d; cephalothin 25 mg/kg to 2 g i.v. 6 hourly or cephazolin 15 mg/kg to 2 g i.v. 8 hourly + metronidazole as above; if possibility of gas gangrene, benzylpenicillin 60 mg/kg to 2.4 g i.v., repeating in 4 h if necessary

SUPPURATIVE WOUND INFECTIONS

Agents: organisms causing **LOCAL AND GENERALISED SEPSIS** in low numbers; low pathogenicity organisms such as coagulase negative *Staphylococcus*

Diagnosis: swab culture after microscopic screening; semiquantitative culture using plastic i.v. catheter on blood agar in surgical incisional wounds

Treatment: antibiotics usually not required; thorough cleansing; surgical drainage; irrigation with isotonic saline or isotonic stabilised 0.05% sodium hypochlorite 12 hourly; local antiseptics (10% mercurochrome or 1% chlorhexidine cream 12 hourly after bathing) or saline dressings

Postoperative:

Mild to Moderate with Surrounding Cellulitis: di(flucloxacillin 12.5 mg/kg to 500 mg orally 6 hourly for at least 5 d or cephalexin 12.5 mg/kg to 500 mg orally 6 hourly for at least 5 d if penicillin hypersensitive; if Gram negative bacilli suspected or proven, amoxicillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally 12 hourly for at least 5 d as single agent

Severe, Systemic Symptoms: di/flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly or cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephazolin 50 mg/kg to 2 g i.v. 8 hourly if penicillin hypersensitive; if Gram negative bacilli suspected or proven, add gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. daily (adjust dose for renal function); if immediate penicillin hypersensitivity or high incidence of MRSA, substitute vancomycin

25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly) for di/flucloxacillin, cephalothin or cephalzolin

Post-traumatic:

Clean Wounds Where Management Delayed or Debridement Difficult: di/flucloxacillin 12.5 mg/kg to 500 mg orally 6 hourly for 5 d + metronidazole 10 mg/kg to 400 mg orally 12 hourly for 5-7 d; amoxicillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally 12 hourly for 5 d

Penicillin Hypersensitive (Not Immediate): substitute cephalexin 12.5 mg/kg to 500 mg orally 6 hourly for 5 d

Immediate Penicillin Hypersensitivity or Possible *Pseudomonas*: ciprofloxacin 10 mg/kg to 500 mg orally 12 hourly for 5 d + clindamycin 10 mg/kg to 450 mg orally 8 hourly for 5 d

Contaminated Wounds: di/flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. daily (adjust dose for renal function) + metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly

Penicillin Hypersensitive (Not Immediate): metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly + cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephalzolin 50 mg/kg to 2 g i.v. 8 hourly

Immediate Penicillin Hypersensitivity: gentamicin 4-6 mg/kg (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg) i.v. daily (adjust dose for renal function) + clindamycin 15 mg/kg to 600 mg i.v. or orally 8 hourly or lincomycin 15 mg/kg to 600 mg i.v. 8 hourly

LOCAL AND GENERALISED SEPSIS: 750,000 cases/y in USA; sepsis = a systemic inflammatory response to infection; severe sepsis = sepsis with one or more dysfunctional organs or systems (death rate 30-35%); systemic inflammatory response syndrome = a syndrome in which inflammatory mediator release causes alterations in body temperature (> 38°C or < 36°C), heart rate > 90 beats/min, alterations in respiratory function (rate > 20 breaths/min or PO₂ < 32 mmHg, alterations in WBC count (> 12000/mm³ or < 4000/mm³ or > 10% immature forms); compensatory anti-inflammatory response syndrome = syndrome in which anti-inflammatory mediator release overcompensates for the systemic inflammatory response; septic shock = severe sepsis with hypotension that is resistant to fluid resuscitation and requires pharmacological intervention (death rate ≈ 50%); multiple organ dysfunction syndrome = syndrome in which hypotension and hypoperfusion, secondary to pathophysiological alterations in severe sepsis, result in dysfunction in multiple organs

Agents: *Staphylococcus aureus* (always significant; 15% of hospital infections); *Streptococcus* (Groups A, C and G, others in hospital infections, *Streptococcus milleri* in abscesses; Group A 0.7% of hospital infections, Group B 2%, Group D 10%); coliforms (mainly in hospital-acquired infections, diabetics, immunosuppressed and severely debilitated patient; also in agricultural wounds; *Escherichia coli* 15% of hospital infections (83% of infections following major abdominal surgery), *Proteus* 7%, *Klebsiella* 5%, *Enterobacter* 4%); *Pseudomonas aeruginosa* (5% of hospital infections) and other *Pseudomonas* species; *Bacteroides fragilis* (3% of hospital infections, 73% of intraabdominal wounds); other anaerobes (other *Bacteroides*, *Clostridium*, *Peptococcus*, 7% of hospital infections, 85% of infections following major abdominal surgery); *Pasteurella*; *Vibrio vulnificus* (case-fatality rate 67% in primary sepsis, 22% in wound infections), *Vibrio cholerae*, *Vibrio mimicus*, *Vibrio parahaemolyticus*, *Vibrio alginolyticus*, *Vibrio damsela* and *Aeromonas* (trauma and exposure to water); *Yersinia pestis*; *Mycobacterium fortuitum*, *Mycobacterium chelonae* and *Mycobacterium smegmatis* (primary and post-surgical (especially cardiac) infections, catheter tunnel infections); *Mycobacterium haemophilum* (immunocompromised); *Chromobacterium violaceum*, *Campylobacter fetus* subsp *fetus* (abscesses); *Campylobacter concisus* (foot ulcer); *Clostridium botulinum*; *Achromobacter*; *Acinetobacter calcoaceticus*; *Eikenella corrodens* (55% of cases related to human bites or fist-fight injuries); *Corynebacterium jeikeium* (local infections at sites of biopsy or catheter insertion or perianal fissure in granulocytopenic patients); *Corynebacterium striatum* (infection of exit sites of central venous catheters); *Corynebacterium urealyticum* (immunosuppressed); *Actinobacillus actinomycetemcomitans* (soft tissue abscess; may be associated with infection with *Actinomyces*); *Moraxella* (rare); *Sarcina* (rare); *Salmonella* (in renal transplant recipients); *Bacillus cereus* (principal cause of traumatic wound infections in tropics); *Streptococcus pneumoniae* (associated with connective tissue disease); *Haemophilus influenzae* (soft tissue abscesses; 45% of nonbacteremic *Haemophilus influenzae* infections in older children and adults); *Campylobacter* (granulocytopenics); *Selenomonas sputigena* (in alcoholics); *Desulphovibrio desulfuricans*; *Candida albicans* (sternal in coronary artery bypass grafting); *Pseudallescheria boydii* (cancer patients); *Trichosporon*, *Fusarium* and *Geotrichum* (mainly disseminated infections in cancer patients); *Aspergillus*, *Alternaria*

Diagnosis: in severe sepsis, organ dysfunction, hypoperfusion or hypotension, fever, tachycardia, tachypnea and elevated white cell count may be present; micro and culture of wound swab, aspirate, body fluids, blood (repeat if negative); serology, counterimmunoelectrophoresis of serum; immunodiffusion, latex agglutination, ELISA (*Bacteroides fragilis* sensitivity

81%, specificity 95%; *Staphylococcus aureus* teichoic acid), radioimmunoassay (*Bacteroides fragilis* sensitivity 75%, specificity 100%)

Wound Botulism: 66% traumatic, 15% injection site, 11% surgical, 6% unknown site, 4% sinusitis; culture of wound, cyst aspirate, stool; electromyogram (median nerve conduction and F-responses normal, amplitude of evoked muscle-action potential low but increased by repetitive stimulation at 10 Hertzogs by 50%); hypercapnia (pCO₂ = 110)

Treatment: in severe sepsis, i.v. fluids if hypotensive or hypoperfusion, vasopressors if hypotension not corrected by i.v. fluids, intubate and ventilate as necessary, control source of sepsis where possible, maintain adequate glycemic control; where not contraindicated, drotrecogin alpha (activated) (recombinant human activated protein C) reduces mortality by 20%

Organism Not Known: as for **MUSCULAR, SKELETAL AND SOFT TISSUE TRAUMA** or, if severe, as for **BACTEREMIA, SEPTICEMIA, SEPTIC SHOCK**

Streptococcus pyogenes: aqueous benzylpenicillin 6-8 MU i.v. daily, procaine benzylpenicillin 1.2-2.4 MU i.m. twice daily, phenoxymethylpenicillin 1-2 g daily orally

Staphylococcus aureus: oxacillin or flucloxacillin 6-12 g i.v. daily in divided doses, cephazolin 3-4 g/d, vancomycin 500 mg every 6 h, dicloxacillin 250-500 mg 4 times a day orally, erythromycin, cephalexin 250-500 mg 4 times a day orally

Enterococci: benzylpenicillin 9-12 MU daily or ampicillin 6-12 g i.v. daily + gentamicin 1 mg/kg 8 hourly

Mycobacterium: debridement, drainage, excision + sulphamethoxazole 1 g orally 8 hourly for 10 w or more; amikacin 500 mg i.v. 12 hourly ± ceftoxitin 1.2 g 4-8 hourly; amikacin 300 mg i.v. 12 hourly + doxycycline 100 mg orally 8 hourly

Corynebacterium jeikeium, Corynebacterium urealyticum, Corynebacterium striatum:
vancomycin

Chromobacterium violaceum: chloramphenicol

Campylobacter fetus subsp fetus: gentamicin

Salmonella: drainage + ampicillin

Vibrio: debridement; doxycycline 100 mg orally or i.v. twice daily + ceftazidime 2 g i.v. 3 times a day or ciprofloxacin 400 mg twice a day for 3 d or gentamicin

Aeromonas: thorough cleaning of wound, topical antiseptics; consider delayed primary closure; surgical drainage + gentamicin

Pseudomonas: ciprofloxacin

Anaerobes: clindamycin

Clostridium botulinum: wound debridement, intensive care, mechanical ventilation when appropriate, antitoxin; tetracycline, metronidazole, chloramphenicol, penicillin

Bacillus cereus:

Mild: flucloxacillin 50 mg (< 2 y: ¼ dose; 2-10 y: ½ dose) orally 6 hourly

Severe: clindamycin 450 mg orally 6 hourly (child: 20 mg/kg daily in equally divided doses)

Candida: ketoconazole 200-400 mg orally daily, fluconazole 50-100 mg orally daily

Aspergillus: amphotericin B; radical debridement essential for management

Alternaria: resection; itraconazole

Fusarium:

Non-neutropenic: itraconazole 200 mg twice daily orally

Neutropenic: amphotericin B 1.0 – 1.5 mg/kg daily, liposomal amphotericin B 5 – 15 mg/kg daily

Methicillin Resistant *Staphylococcus aureus* Control: povidone iodine gauze pads, application of 2% mupirocin calcium ointment to nares of carriers twice daily for 5 d or to wounds daily for 2 w, showering and shampooing with triclosan 2% liquid soap 12 hourly, shortening period of perioperative antibiotic cover, routine postoperative perineal swabs, wearing masks while tending infected patients

CELLULITIS, FASCIITIS, GANGRENE, MYONECROSIS, MYOSITIS, PYOMYOSITIS: 0.7% of new episodes of illness in UK; 0.5% of ambulatory care visits in USA; cellulitis = painful, erythematous infection of deep skin with poorly demarcated borders

Agents: *Streptococcus pyogenes* (may be gangrenous or pyomyositis in diabetics; also perianal in young children), *Staphylococcus aureus* (> 90% of pyomyositis—myositis purulenta tropica, staphylococcal pyomyositis, tropical myositis, tropical pyomyositis), *Mycobacterium fortuitum* (emerging pathogen in AIDS), *Mycobacterium smegmatis*, *Pseudomonas aeruginosa* (punctures or surgical wounds), *Aeromonas hydrophila* (soft tissue trauma associated with water; cellulitis ± bullae, abscesses and crepitant, necrotising, myonecrosis), *Edwardsiella tarda* (similar to *Aeromonas*), *Yersinia enterocolitica*

(pyomyositis in diabetics), halophilic *Vibrio* (*Vibrio alginolyticus*, *Vibrio parahaemolyticus*, *Vibrio vulnificus*), *Serratia marcescens* (rare pyomyositis), *Haemophilus influenzae* (usually type b; buccal, associated with otitis media; rare pyomyositis), *Streptococcus milleri*, *Streptococcus canis*, Group C *Streptococcus*, *Streptococcus pneumoniae* (children, chronic illness, alcoholics and i.v. drug users), *Streptococcus agalactiae* (rare; diabetics; including pyomyositis), *Salmonella* (in renal transplant recipients), *Erysipelothrix rhusiopathiae*, *Corynebacterium jeikeium* (biopsy sites in granulocytopenic patients), *Mycoplasma hominis*, *Shewanella putrefaciens* (lower limb), *Edwardsiella tarda* (associated with trauma to mucosal surfaces), *Clostridium perfringens* and other *Clostridium* (*Clostridium fallax*, *Clostridium novyi*, *Clostridium oedematiens*, *Clostridium septicum*, *Clostridium sporogenes*; gas gangrene, clostridial cellulitis, clostridial myonecrosis (anaerobic myositis, clostridial myositis) from contamination of wounds, incubation period hours; *Clostridium septicum* also spontaneous nontraumatic associated with colon lesions, diabetes, leucopenia), anaerobic streptococci, *Peptococcus*, *Neisseria gonorrhoeae* (rare pyomyositis), *Neisseria mucosa* (rare), *Klebsiella oxytoca* (uncommon pyomyositis), *Legionella pneumophila* (one case associated with pneumonia), *Acinetobacter calcoaceticus*, *Campylobacter jejuni*, *Succinimonas amylolytica* (single case of groin cellulitis and abscess), *Stenotrophomonas maltophilia* (associated with neutropenia, prolonged hospitalisation, intensive care unit stay, broad spectrum antibiotic exposure), mixed aerobes and anaerobes, *Mucorales* (uncommon; fulminant necrotising or indolent), *Scedosporium* (post-traumatic), *Bipolaris*, *Cryptococcus*

Diagnosis: excruciating pain, swelling of tissues, crepitation, bulla formation; Gram stain and culture of swab from deep in necrotic tissue; specimens from sinus tracts or draining wounds may be taken by aspiration by syringe and small plastic catheter introduced as deeply as possible through decontaminated skin orifice, but a specimen obtained at surgery from the depths of the wound or underlying bone lesion is always preferable; curettings and tissue biopsies provide excellent material; Gram stain will frequently be an important clue to nature of infection; blood cultures; Doppler imaging to rule out deep vein thrombosis in absence of visible port of entry or recognisable predisposing factor in elderly

Necrotising Infections: edema > erythema, skin vesicle, subcutaneous gas, absence of lymphadenitis/lymphangitis; later, skin echymoses, anesthesia, fever, hypotension

Anaerobic Cellulitis: will often be suspected clinically because of smell and appearance of wound

Clostridial Cellulitis: production of gas in subcutaneous tissue, resulting in their destruction; some local pain, moderate fever and crepitation common

Clostridial Myonecrosis: local pain in region of wound, toxemia, toxic delirium, edema, production of bullae, tissue necrosis (in that order)

Gas Gangrene: necrosis and production of gas in tissues; gas in soft tissues may be due to *Clostridium*, *Escherichia coli*, *Klebsiella*, *Peptostreptococcus*, *Bacteroides*, *Fusobacterium*, *Streptococcus pyogenes*, mixed facultative and anaerobic bacteria, or noninfectious (eg., trapped air following trauma or surgery)

Streptococcal: extremely rapid spread; patient appears toxic; lymphangitis prominent

Staphylococcal: more indolent, central fluctuance

Pyomyositis: fever, muscle pain; needle aspiration if visible mass; ultrasonography, X-ray, radionuclide bone scintigraphy, gallium scan, MRI

Haemophilus: primarily in children aged 3 mo - 3 y; bluish tinge; frequently facial

Aeromonas: inflammation of connective tissue often resembling β -haemolytic streptococcal cellulitis; occasionally seen as a granulomatous ulcer; rarely hemorrhage, necrosis and liquefaction of soft tissues (muscle), subcutaneous gas formation, muscle fibres separated and lysed (high mortality associated with positive blood culture); usually results from exposure of lesion to fresh water

Vibrio: exposure to marine water; widespread fasciitis and myonecrosis; case-fatality rate 7-33%

Other Gram Negative Bacilli: immunocompromised host

Erysipelothrix rhusiopathiae: summer peak; exposure to fish, shellfish; erysipeloid; joint involvement common

Mycoplasma hominis: postcaesarean and others; culture on ATB or Mycotrim-GU (Hana)

Treatment: surgical incision and drainage of abscesses and surgical debridement of all necrotic tissue + antimicrobial; planned relook 24-48 h

Mild Early: di/flucloxacillin 12.5 mg/kg to 500 mg orally 6 hourly for 7-10 d

Penicillin Hypersensitive (Not Immediate): cephalexin 12.5 mg/kg to 500 mg orally 6 hourly for 7-10 d

Immediate Penicillin Hypersensitivity: clindamycin 10 mg/kg to 450 mg orally 8 hourly for 7-10 d

Severe: di/flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly

Penicillin Hypersensitive (Not Immediate): cephalothin 50 mg/kg to 2 g i.v. 6 hourly, cephalazolin 50 mg/kg to 2 g i.v. 8 hourly

Immediate Penicillin Hypersensitivity: clindamycin 10 mg/kg to 450 mg i.v. or orally 8 hourly, lincomycin 15 mg/kg to 600 mg i.v. 8 hourly, vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly)

Streptococcus pyogenes:

Severe: benzylpenicillin 30 mg/kg to 600 mg i.v. 4 hourly

Penicillin Hypersensitive (Not Immediate): cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephalazolin 25 mg/kg to 1 g i.v. 8 hourly

Immediate Penicillin Hypersensitivity: clindamycin 10 mg/kg to 450 mg i.v. then 10 mg/kg to 450 mg orally 8 hourly; lincomycin 15 mg/kg to 600 mg i.v. 8 hourly, then clindamycin 10 mg/kg to 450 mg orally 8 hourly; vancomycin 20 mg/kg to 1 g i.v. slowly 12 hourly

Home-based Therapy: cephalzolin 2 g i.v. 12 hourly for 4-7 d; cephalzolin 2 g i.v. daily for 4-7 d + probenecid 1 g orally daily for 4-7 d

Less Severe: procaine penicillin 50 mg/kg to 1.5 g daily, phenoxymethylpenicillin 10 mg/kg to 500 mg orally 6 hourly for 7 d

Penicillin Hypersensitive: clindamycin 10 mg/kg to 450 mg orally 8 hourly

Staphylococcus aureus:

Less Severe: di(fluc)loxacin 25 mg/kg to 500 mg orally 6 hourly

Penicillin Hypersensitive: clindamycin 10 mg/kg to 450 mg orally 8 hourly

Severe: di/flucloxacillin 50 mg/kg to maximum 2 g i.v. 6 hourly

Penicillin Hypersensitive, Home-based Therapy: as for *Streptococcus pyogenes*

Methicillin Resistant *Staphylococcus aureus:*

Mild: fusidic acid 500 mg (5-12 y: 250 mg) orally 8 hourly + rifampicin 600 mg orally twice daily (not pregnant; child: 1 mo - 1 y: 10 mg/kg daily; > 1 y: 20 mg/kg to maximum 120 mg daily)

Severe: vancomycin 500 mg i.v. 6 hourly over 60 min for 4 w (child: 44 mg/kg i.v. daily in divided doses) + gentamicin 1 mg/kg (child: 1.5-2.5 mg/kg) i.v. 8 hourly for at least 2 w or rifampicin as above

Clostridium: complete surgical wound debridement of necrotic tissue; hyperbaric oxygen if severe; benzylpenicillin 60 mg/kg to 2.4 g i.v. 4 hourly; if immediate penicillin hypersensitivity, metronidazole 12.5 mg/kg to 500 mg i.v. 8 hourly

Other Anaerobes: chloramphenicol 500 mg orally 6 hourly (child > 2 w: 50 mg/kg daily orally in 4 divided doses; premature, newborn and those with immature metabolism: 25 mg/kg daily in 4 divided doses), metronidazole as for *Clostridium*

Mycobacterium fortuitum: 2 of clarithromycin, doxycycline, ciprofloxacin, cotrimoxazole orally for 6-12 mo

Mycobacterium smegmatis: extensive skin debridement followed by skin grafting

Haemophilus influenzae:

Severe: cefotaxime 500 mg i.v. 6 hourly (child: 30-50 mg/kg i.v. 6-8 hourly), chloramphenicol as for

Other Anaerobes

Less Severe: amoxicillin-clavulanate 40/10 mg/kg/d to maximum 1.5/0.375 g in 3 divided doses

Aeromonas hydrophila, Edwardsiella tarda: ciprofloxacin, aminoglycoside, third generation cephalosporin

Vibrio: doxycycline 100 mg orally or i.v. twice daily + ceftazidime 2 g i.v. 3 times a day or ciprofloxacin 400 mg twice a day for 3 d or gentamicin

Mycoplasma hominis: doxycycline

Stenotrophomonas maltophilia: resection + cotrimoxazole + ticarcillin-clavulanate + aztreonam

Other Aerobic Gram Negatives: ticarcillin + gentamicin

Erysipelothrix rhusiopathiae: penicillin

Fungi: amphotericin B 0.75mg/kg/d

Prophylaxis (Recurrent *Streptococcus pyogenes* Cellulitis): phenoxymethylpenicillin 250 mg orally twice daily for up to 6 mo

NECROTISING FASCITIS: incidence in adults 0.4/100,000, in children 0.08/100,000; mortality rates up to 73%; diabetes mellitus, immunosuppressive medications and AIDS predispose

TYPE I (PROGRESSIVE SYNERGISTIC BACTERIAL GANGRENE)

Agents: classically microaerophilic streptococci + *Staphylococcus aureus* (Meleney's synergistic gangrene) but also applied to situations involving other streptococci (30% of isolates), *Staphylococcus aureus* (gives a chronic condition), Gram negative bacilli (especially *Escherichia coli*, *Pseudomonas*, *Shigella*, *Enterobacter*, *Proteus*, *Serratia*), *Enterococcus faecalis* and various anaerobes (particularly *Bacteroides*, *Peptostreptococcus*, *Clostridium*, *Peptococcus*); may develop as a complication of foot and leg sores in diabetics, occasionally in other situations; Fournier's gangrene is necrotising fasciitis of scrotum rapidly progressing to penis and is caused by *Peptostreptococcus* in association with *Proteus*, *Escherichia coli*, *Staphylococcus aureus*, β -haemolytic streptococci (rarely *Streptococcus agalactiae* associated with diabetes) and various anaerobes; may follow use of nonsteroidal antiinflammatory drugs in treating inflammatory cutaneous lesions

TYPE II (Hemolytic Streptococcal Gangrene): prior injury (penetrating injuries, cuts, burns, blunt trauma, muscle strain, surgical incisions, irradiation, cancer, diabetes, infection on trunk, alcoholism, HIV infection, cardiovascular and pulmonary disease, puerperium predisposing factors; also associated with use of nonsteroidal antiinflammatory drugs in varicella; 74% mortality

Agents: *Streptococcus pyogenes*, occasionally in combination with *Staphylococcus aureus*

Diagnosis: localised pain \pm swelling, tenderness or erythema in 87%, gastrointestinal complaints (nausea, vomiting, diarrhoea) in 53%, influenza-like symptoms (aches, chills, fever) in 47%; culture of swab or biopsy from deep in wound; blood cultures; C reactive protein \geq 16 mg/dL (positive predictive value 44%, negative predictive value 99%), creatine kinase \geq 600 U/L (positive predictive value 58%, negative predictive value 95%); MRI (94% accuracy) or CT scan (exudates extending along fascial planes); frozen section; 'finger test' pathognomonic

Treatment: operative removal of devitalised tissue; meropenem 25 mg/kg to 1 g i.v. 8 hourly + clindamycin 15 mg/kg to 600 mg i.v. 8 hourly or lincomycin 15 mg/kg to 600 mg i.v. 8 hourly; supportive care in ICU critical

Streptococcus pyogenes: benzylpenicillin 45 mg/kg to 1.8 g i.v. 4 hourly + clindamycin 15 mg/kg to 600 mg i.v. 8 hourly or lincomycin 15 mg/kg to 600 mg i.v. 8 hourly + normal immunoglobulin 0.4-2 g/kg i.v. for 1 or 2 doses during first 72 h; debridement; hyperbaric oxygen

Penicillin Hypersensitive: substitute cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephazolin 50 mg/kg to 2 g i.v. 8 hourly for benzylpenicillin

Pseudomonas aeruginosa: extensive debridement and resection; combination antipseudomonas antimicrobial therapy; leucocyte transfusions or colony-stimulating factors

Polymicrobial: meropenem 25 mg/kg to 1 g i.v. 8 hourly

LYMPHOCUTANEOUS SYNDROME

Agents: *Sporothrix schenckii* (most common), *Nocardia brasiliensis* (very common), *Mycobacterium marinum* (very common), *Leishmania braziliensis* (very common in endemic areas), *Leishmania tropica* (common in endemic areas), *Coccidioides immitis* (common), *Francisella tularensis* (common), *Mycobacterium chelonae* (common), less frequent *Ajelloomyces dermatitidis*, *Cryptococcus neoformans*, *Fusarium*, *Histoplasma capsulatum*, *Scedosporium apiospermum*, *Scopulariopsis*, *Nocardia asteroides*, *Nocardia otitidiscaviarum*, *Nocardia transvalensis*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Mycobacterium avium-intracellulare*, *Mycobacterium flavescens*, *Mycobacterium fortuitum* (emerging pathogen in AIDS), *Mycobacterium kansasii*, *Mycobacterium tuberculosis*, *Leishmania major*, cowpox virus, simplexvirus

Diagnosis: biopsy and culture of skin lesion, lymph node

Treatment:

Scedosporium apiospermum: ketoconazole, fluconazole, flucytosine

Sporothrix schenckii: itraconazole

Other Fungi: amphotericin B 0.75 mg/kg i.v. daily for 2-4 w \pm flucytosine 25 mg/kg i.v. or orally 6 hourly for 14 d

Francisella tularensis: streptomycin, tetracycline

Staphylococcus aureus: cloxacillin, flucloxacillin, cephalothin

Streptococcus pyogenes: penicillin, erythromycin

Nocardia*, *Mycobacterium chelonae*, *Mycobacterium fortuitum: 2 of clarithromycin, doxycycline, ciprofloxacin, cotrimoxazole orally for 6-12 mo

Mycobacterium avium-intracellulare: ethambutol 15 mg/kg orally daily or 25 mg/kg orally 3 times weekly (not < 6 y) + clarithromycin 12.5 mg/kg to 500 mg orally 12 hourly daily or 3 times weekly or azithromycin 10 mg/kg to 500 mg orally daily or 10 mg/kg to 600 mg orally 3 times weekly + rifampicin 10 mg/kg to 600 mg orally daily or 3 times weekly or rifabutin 5 mg/kg to 300 mg orally daily

Mycobacterium kansasii: isoniazid 10 mg/kg to 300 mg orally daily + rifampicin 10 mg/kg to 600 mg orally twice daily + ethambutol 15 mg/kg orally (not < 6 y) daily for 18 mo and 12 mo negative sputum cultures

Mycobacterium marinum: clarithromycin 12.5 mg/kg to 500 mg orally 12 hourly, cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly, doxycycline 2.5 mg/kg to 100 mg orally (not < 8 y) 12 hourly

Severe or Unresponsive: clarithromycin + rifampicin or ethambutol

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 μ M/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isoniazid and rifampicin (to 6 mo)

Leishmania: sodium stibogluconate

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: famciclovir 500 mg orally 12 hourly, valaciclovir 500 mg orally 12 hourly, aciclovir 200 mg orally 8 hourly or 400 mg orally 12 hourly

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

RHABDOMYOLYSIS: 5% due to infectious causes

Agents: influenza virus, human parainfluenza virus, coxsackievirus, echovirus, *Epstein-Barr virus*, *hepatitis B virus*, *simplexvirus*, adenovirus, *Clostridium*, *Streptococcus pneumoniae*, other *Streptococcus*, *Staphylococcus aureus*, *Salmonella typhi*, *Shigella sonnei*, *Shigella flexneri*, *Legionella*, *Haemophilus parainfluenzae*, *Escherichia coli*, *Vibrio vulnificus*, *Klebsiella pneumoniae*, *Leptospira*

Diagnosis: culture of muscle biopsy, blood; test of urine for myoglobin; serology; raised serum aldolase, serum creatine kinase

Treatment: ticarcillin + tobramycin

SARCOCYSTOSIS

Agent: *Sarcocystis suihominis*

Diagnosis: histology of cysts in muscle

Treatment: none satisfactory

SYMMETRICAL PERIPHERAL GANGRENE: complication of septicemia

Agents: usually Gram negative bacilli; also staphylococci and streptococci

Diagnosis: culture of blood and urine

Treatment: dependent on isolate

NASAL SEPTAL ABSCESS

Agents: *Staphylococcus aureus*, *Streptococcus pneumoniae*, β -haemolytic streptococci, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Escherichia coli*

Diagnosis: culture of aspirate

Treatment: cephalexin + gentamicin + aspiration, drainage and nasal packing

ISCHIORECTAL ABSCESS

Agents: *Clostridium*, *Bacteroides*, *Staphylococcus aureus* (coliforms and enterococci which may be isolated are not significant)

Diagnosis: culture of swab from deep in abscess

Treatment: penicillin, cephalosporin or erythromycin + metronidazole

PERIANAL AND PERIRECTAL ABSCESS AND CELLULITIS IN PATIENTS WITH MALIGNANT DISEASE

Agents: *Escherichia coli*, Group D *Streptococcus*, *Bacteroides fragilis*, *Clostridium*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* (55% of patients with acute leukemia; > 50% case-fatality rate in these cases), *Proteus mirabilis*, *Citrobacter freundii*, *Staphylococcus aureus*, *Enterobacter cloacae*, *Candida albicans*

Diagnosis: swab culture

Treatment: ceftazidime + clindamycin, piperacillin + tobramycin + clindamycin; + vancomycin if progression; + surgery if inadequate response

PERIANAL CELLULITIS IN YOUNG CHILDREN

Agent: *Streptococcus pyogenes*

Diagnosis: culture of anal swab

Treatment: phenoxymethylpenicillin 10 mg/kg to 500 mg orally 6 hourly for 7 d

PSOAS ABSCESS: ≈ 12 reported cases/y worldwide; predisposing conditions diabetes, immunosuppression, renal failure

Agents: *Staphylococcus aureus* (80% of primary), *Pseudomonas aeruginosa*, *Haemophilus aphrophilus*, *Proteus mirabilis*, *Escherichia coli*, *Streptococcus viridans*, β-haemolytic streptococci, *Enterobacter*, *Salmonella enteritidis*, *Enterococcus*, *Serratia marcescens*, *Bacteroides fragilis*, *Mycobacterium tuberculosis* (uncommon), *Mycobacterium kansasii*, *Mycobacterium xenopi*, *Pasteurella multocida*, *Salmonella typhi* (rare), *Candida tropicalis*, *Torulopsis glabrata*

Diagnosis: computerised tomography; Gram stain and culture of aspirate; culture of blood and urine

Treatment: surgical drainage +:

Staphylococcus aureus: cloxacillin

Streptococci, *Pasteurella multocida:* penicillin

Serratia marcescens: gentamicin

Anaerobes: metronidazole

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 isoniazid and rifampicin (to 6 mo)

Salmonella typhi: ciprofloxacin 1.5 g/d orally

Candida, Torulopsis: amphotericin B

Organism Not Known: cloxacillin + gentamicin + clindamycin

INTRAABDOMINAL ABSCESS: 12% from pancreatitis, 10-20% from appendicitis, 10% from genitourinary tract, 8% from biliary tract, 7% from diverticulitis, 3% from trauma, 3% from perforating tumours, 2% from peptic ulcer, 2% from leaking suture line, 15-30% from miscellaneous sources, 10% from unknown source

Agents: 80-95% *Bacteroides fragilis*, 80-95% *Escherichia coli*, 60% *Enterococcus*, 50% anaerobic streptococci, 50% *Clostridium*, 40% *Fusobacterium*, 38% *Proteus*, *Eikenella corrodens*, other *Bacteroides*, *Prevotella*, *Desulfovibrio desulfuricans*

Diagnosis: fever in 82%, abnormal chest film in 61%, abdominal pain in 38%, persistent drainage in 18%, abnormal plain film of abdomen in 14%, chest dullness in 12%, abdominal mass by palpation in 7%; liver-lung scan (98% accurate), CT scan (98% accurate), ultrasound (96% accurate), gallium scan (82% accurate); culture of aspirate or surgical specimen

Treatment: clindamycin, chloramphenicol

PERINEPHRIC ABSCESS

Agents: *Staphylococcus* (36% of cases in renal transplant recipients), aerobic Gram negative bacilli (32% of cases in renal transplant recipients), anaerobes (28% of cases in renal transplant recipients), *Candida albicans* (4% of cases in renal transplant recipients), *Mycobacterium intracellulare*

Diagnosis: fever, abdominal tenderness; computed tomography, intravenous pyelogram, cystogram; culture of material obtained by surgery or percutaneous drainage

Treatment: surgical drainage + appropriate antimicrobials

PELVIC ABSCESS, PELVIC INFLAMMATORY DISEASE, PARAMETRITIS: 62% salpingitis, 22% normal findings, 5% ovarian cysts, 4% ectopic pregnancy, 3% appendicitis, 1% endometriosis; important cause of ectopic pregnancy, sterility and tuboovarian abscess; increasing importance in Australia and other developed nations; vaginal douching a risk factor

Agents: *Neisseria gonorrhoeae*, *Chlamydia trachomatis* (1/4 – 1/2 of the million recognised cases in USA each year), *Bacteroides*, anaerobic Gram positive cocci, *Escherichia coli*, *Actinomyces israelii* (almost exclusively associated with use of IUD), *Mycoplasma hominis*, *Ureaplasma urealyticum*, *Haemophilus influenzae* (IUD related and maternal), *Streptococcus pyogenes*, *Streptococcus milleri*, *Streptococcus pneumoniae* (IUD, recent birth, gynecologic surgery), *Clostridium perfringens*, *Candida* (associated with suture, IUD)

Diagnosis: diffuse pelvic (uterine/adnexal, cervical motion) tenderness associated with pelvic pain and abnormal cervical or vaginal mucopurulent discharge, oral temperature > 38.3°C, leucocytes on saline microscopy of vaginal secretions, elevated erythrocyte sedimentation rate, elevated C-reactive protein; increased frequency in patients with IUDs; endometrial biopsy with histopathologic evidence of endometriosis; transvaginal sonography or magnetic resonance imaging showing

thickened, fluid-filled tubes with or without free pelvic fluid or tubo-ovarian complex; laparoscopy; Gram stain and culture of swab or pus; direct immunofluorescence on cervical smears (*Chlamydia*, *Actinomyces israelii*)

Treatment: hospitalise if surgical emergencies cannot be excluded, the patient is pregnant, the patient does not respond clinically to oral antimicrobial therapy, the patient is unable to follow or tolerate an outpatient oral regimen, the patient has severe illness, nausea and vomiting or high fever, or the patient has a tubo-ovarian abscess

Likely to be Sexually Acquired:

Mild to Moderate: azithromycin 1 g orally as single dose weekly for 2 w + ceftriaxone 250 mg i.m. or i.v. as single dose + metronidazole 400 mg orally 12 hourly for 14 d or tinidazole 500 mg orally daily for 14 d

Severe: doxycycline 100 mg orally or i.v. 12 hourly + cefoxitin 2 g i.v. 8 hourly, doxycycline 100 mg orally or i.v. 12 hourly + metronidazole 500 mg i.v. 12 hourly + ceftriaxone 1 g i.v. daily or cefotaxime 1 g i.v. 8 hourly

Penicillin Hypersensitive: gentamicin 4-6 mg/kg (adjust dose for renal function) i.v. daily + clindamycin 600 mg i.v. 8 hourly or lincomycin 600 mg i.v. 8 hourly

Treatment for Sexual Partners: doxycycline 100 mg orally twice daily for 7 d, tetracycline 500 mg 6 hourly for 7 d, erythromycin 500 mg 6 hourly for 7 d

Mild to Moderate Infection, Not Sexually Acquired: remove any IUD or retained products of conception as soon as possible; amoxicillin-clavulanate 875/125 mg orally 12 hourly + doxycycline 100 mg orally 12 hourly for 14 d

Pregnant or Breastfeeding: substitute roxithromycin 300 mg orally daily for 14 d for doxycycline

Related to Trauma or Pregnancy: amoxy/ampicillin 2 g i.v. 6 hourly + metronidazole 500 mg i.v. infused over 20 min 12 hourly or 1 g rectally 8 hourly + gentamicin 4-6 mg/kg i.v. 8 daily (adjust for renal function)

Streptococci, *Clostridium perfringens*: benzylpenicillin 2.4 g i.v. 4 hourly

***Candida albicans*:** amphotericin B

PERITONITIS: primary; secondary due to obstruction, infarction, perforation, neoplasm, foreign body, inflammatory bowel disease; spontaneous in patients with ascites due to cirrhosis of liver or nephrotic syndrome; during peritoneal dialysis

Agents: coliforms (primary, secondary, spontaneous; *Klebsiella* 1-6 % of infections in continuous ambulatory peritoneal dialysis, *Escherichia coli* 0-15% of infections in continuous ambulatory peritoneal dialysis; *Enterobacter cloacae*, *Citrobacter freundii*, infrequently *Kluyvera ascorbata*), anaerobes (primary and secondary, < 5% of infections in continuous ambulatory peritoneal dialysis; *Bacteroides*, *Prevotella*, Gram positive cocci, *Clostridium perfringens*, *Bifidobacterium*, *Eubacterium*), *Streptococcus agalactiae* (primary and secondary), *Streptococcus pneumoniae* (primary and spontaneous), *Streptococcus pyogenes* (primary and secondary), *Enterococcus* (primary and secondary and 2-11% of infections in continuous ambulatory peritoneal dialysis), *Streptococcus milleri* (primary and secondary), *Streptococcus viridans* (5-21% of infections in continuous ambulatory peritoneal dialysis), *Staphylococcus aureus* (primary and 9-24% of infections in continuous ambulatory peritoneal dialysis), coagulase negative *Staphylococcus* (primary and adherent strains in 32-45% of infections in continuous ambulatory peritoneal dialysis), *Neisseria gonorrhoeae* (primary; gonococcal perihepatitis (Fitz-Hugh syndrome, Fitz-Hugh and Curtis syndrome, Fitz-Hugh-Curtis syndrome, gonococcal perihepatitis, gonococcal peritonitis of the upper abdomen, Stojano subcostal syndrome, Stojano syndrome, subcostal syndrome); upper abdominal peritonitis arising by extension of gonococcal salpingitis, with string-like adhesions between liver and abdominal wall), *Chlamydia trachomatis*, *Actinomyces israelii*, *Mycoplasma hominis*, *Pseudomonas* (primary and secondary and in 0-8% of infections in peritoneal dialysis), *Mycobacterium tuberculosis* (primary; 0.2% of tuberculosis cases), *Capnocytophaga* (primary and secondary), *Listeria monocytogenes*, *Neisseria meningitidis*, *Aeromonas* (nosocomial), *Haemophilus influenzae* (13% of non-bacteremic invasive *Haemophilus influenzae* infections in older children and adults), *Campylobacter fetus* subsp *fetus*, *Pseudomonas luteola* and *Pseudomonas oryzihabitans* (in continuous ambulatory peritoneal dialysis), *Agrobacterium tumefaciens* (in continuous ambulatory peritoneal dialysis), *Rothia mucilaginosa* (in continuous ambulatory peritoneal dialysis), *Mycobacterium chelonae* and *Mycobacterium fortuitum* (in < 3% of infections in continuous ambulatory peritoneal dialysis; emerging pathogen in AIDS), *Corynebacterium jeikeium* (in continuous ambulatory peritoneal dialysis), *Sphingobacterium multivorum* (spontaneous), *Alcaligenes xylosoxydans xylosoxydans*, *Bordetella bronchiseptica*, *Pasteurella multocida* (infant appendicinal), *Nocardia* (infrequent in continuous ambulatory peritoneal dialysis), *Bacteroides fragilis* in continuous ambulatory peritoneal dialysis complicating colon cancer, fungi (in ≤ 5% of infections in continuous ambulatory peritoneal dialysis; 42% *Candida albicans*, 14% *Candida tropicalis*, 8% *Candida parapsilosis*, 3% *Candida guilliermondii*, 2% *Candida glabrata*, 1% *Candida krusei*, 6% other *Candida*, 7% *Fusarium*, 3% *Rhodotorula rubra*, 2% *Bipolaris spicifera*, 1% *Mucor*, 1% *Aspergillus flavus*, 1% *Aspergillus fumigatus*, 1% *Dreschlera*, 1% *Trichoderma longibrachiatum* and *Trichoderma viride*, 1% *Exophiala jeanselmei*, 1% *Cephalosporium*, rare *Alternaria*, *Curvularia*, *Trichosporon beigelii*, *Cochliobolus australiensis*, *Bipolaris spicifera*; *Cryptococcus* up to 6% and *Coccidioides* up to 4% in some series), amoebae (secondary), *Strongyloides* (secondary), *Balantidium coli* (very rare)

Diagnosis: culture of swab or pus; counterimmunoelectrophoresis of serum, peritoneal fluid; urinalysis reagent strip test for leucocyte esterase on ascitic fluid ($> 3 = +ve$ gives sensitivity 89%, specificity 99%, positive predictive value 98%; $> 2 = +ve$ gives sensitivity 96%, specificity 89%, negative predictive value 99%; direct immunofluorescence of cervical smears (*Chlamydia*, *Actinomyces israelii*); serum lipase often increased

Gonococcal Perihepatitis: right upper quadrant pain and tenderness

Tuberculous: laparoscopy

Continuous Ambulatory Peritoneal Dialysis: cloudy dialysis effluent in 95% of cases, abdominal pain in 78%, abdominal tenderness in 76%; peritoneal dialysis fluid white cell count (90-2880 cells/mL with 56-99% polymorphonuclears in fungal peritonitis) and culture as for blood culture (Isolator, Bactec, BacT/Alert Aerobic FAN)

Treatment:

Suspected Associated with PID: doxycycline + cefoxitin 2 g i.v. 8 hourly

Suspected Bowel Origin: amoxy(ampi)cillin 50 mg/kg to 2 g i.v. 6 hourly + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. as single daily dose (adjust dose for renal function) + metronidazole 12.5 mg/kg to 500 mg i.v. infused over 20 min 12 hourly

Gentamicin Contraindicated: 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

Penicillin Hypersensitive (Not Immediate): metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly + cefotaxime 25 mg/kg to 1 g i.v. 8 hourly or ceftriaxone 25 mg/kg to 1 g i.v. daily

Immediate Penicillin Hypersensitive: vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly) + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. as single daily dose (adjust dose for renal function) + metronidazole 12.5 mg/kg to 500 mg i.v. infused over 20 min 12 hourly

Spontaneous: ceftriaxone 25 mg/kg to 1 g i.v. once daily or cefotaxime 25 mg/kg to 1 g i.v. 8 hourly or ticarcillin + clavulanate 50 + 1.7 mg/kg to 3 + 0.1 g i.v. 6 hourly + (if receiving cotrimoxazole or norfloxacin prophylaxis or enterococcal infection likely) amoxy/ampicillin 25 mg/kg to 1 g i.v. 6 hourly

Continuous Ambulatory Peritoneal Dialysis: flush 2 X 1 L exchanges of dialysate

Gram Positive Organisms Seen in Dialysate: cephalothin 15 mg/kg added to 1 bag/d (intermittent) or 500 mg/L initially then 125 mg/L (continuous with each bag exchange), cephalosporin 15 mg/kg added to 1 bag/d (intermittent) or 500 mg/L initially then 125 mg/L (continuous with each bag exchange), vancomycin 25 mg/L in each bag of dialysate or 50 mg/kg to 2 g i.p. as single dose, repeated after 7 d

Gram Negative Bacilli Seen in Dialysate: gentamicin 4-8 mg/L to each bag of dialysate to maximum 40 mg/d in dialysate for 10-20 d or 50 mg i.p. as single daily dose for 10-21 d

Diverticular Disease or Bowel Involvement Suspected: as above + metronidazole 400 mg orally or 500 mg i.v. 12 hourly

Streptococci and *Neisseria gonorrhoeae*: penicillin 100,000 U/kg/d

Staphylococci:

Primary: penicillinase-resistant penicillin 150-200 mg/kg/d

Peritoneal Dialysis: as for **Continuous Ambulatory Peritoneal Dialysis**

Mixed Aerobes and Anaerobes: gentamicin or tobramycin 5-7 mg/kg/d + clindamycin 30 mg/kg/d or chloramphenicol 50-100 mg/kg/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 μ M/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isoniazid and rifampicin (to 6 mo)

***Mycobacterium chelonae*, *Mycobacterium fortuitum*:** 2 of clarithromycin, doxycycline, ciprofloxacin, cotrimoxazole orally for 6-12 mo

***Rothia mucilaginosa*:** vancomycin

***Capnocytophaga*, *Listeria monocytogenes*:** ampicillin

Fungi: amphotericin B total dose of 2-10 mg/kg X 7-14 d i.v. + 1.5-2 mg/L in dialysate up to a total dose of 1500 mg \pm flucytosine, followed by catheter removal (essential for management); *Trichoderma* resistant to most agents

Prophylaxis (Spontaneous Bacterial in Patients with Ascites and Gastrointestinal Bleeding or Ascitic Protein Concentration < 10 g/L or With Previous History): cotrimoxazole 4/20 mg/kg to 160/800 mg orally daily or, if contraindicated or previous failure, norfloxacin 10 mg/kg to 400 mg orally daily

CERVICAL FASCIAL SPACE INFECTIONS: submandibular (Ludwig's angina; follows infection of second or third mandibular tooth in 70-85% of cases; potentially life-threatening), lateral pharyngeal (postanginal sepsis (necrobacillosis, Lemierre's disease); dental infections, rarely parotitis, otitis, mastoiditis), retropharyngeal, danger and prevertebral spaces (suppurative adenitis following upper respiratory tract infection, traumatic penetration, odontogenic)

Agents: *Streptococcus pyogenes*, *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Bacteroides*, *Peptostreptococcus*, *Fusobacterium necrophorum*, *Eikenella corrodens*, *Arcanobacterium haemolyticum*

Diagnosis: ultrasonography, computerised axial tomography; blood cultures; serum alkaline phosphatase 81-330 IU/mL, serum bilirubin total 0.4-10.8 mg/dL, direct 0-7.5 mg/dL, serum gamma-glutamyl transferase 106-258 U/mL, serum glutamic-oxaloacetic acid transaminase 93-192 U/mL, serum glutamic-pyruvic acid transaminase 16-66 U/mL, serum lactic dehydrogenase 212-393 IU/mL, white cell count 7200-31,400/ μ L

Submandibular: pain, minimal trismus, swelling of mouth floor and submylohyoid region, dysphagia and dyspnoea present if bilateral involvement

Anterior Lateral Pharyngeal: severe pain, prominent trismus, swelling of anterior lateral pharynx and angle of jaw, dysphagia, occasional dyspnoea; followed by bacteremia and metastatic abscesses in necrobacillosis

Posterior Lateral Pharyngeal: minimal pain, minimal trismus, swelling of posterior lateral pharynx (hidden), dysphagia and severe dyspnoea

Retropharyngeal/Danger: pain, minimal trismus, swelling of posterior pharynx, dysphagia and dyspnoea

Treatment: airway management, heparin + surgical drainage or computed tomography-guided needle aspiration +: metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly + benzylpenicillin 30 mg/kg to 1.2 g i.v. 6 hourly or amoxy/ampicillin 50 mg/kg to 2 g i.v. 6 hourly; with clinical improvement, change to metronidazole 10 mg/kg to 400 mg orally 12 hourly + phenoxymethylpenicillin 10 mg/kg to 500 mg orally 6 hourly or amoxicillin 10 mg/kg to 500 mg orally 8 hourly, or amoxicillin + clavulanate 22.5 + 3.2 mg/kg to 875 + 125 mg orally 12 hourly alone, for further 5 d

Penicillin Hypersensitive: clindamycin 10 mg/kg to 450 mg i.v. 8 hourly or 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

CRANIAL PARAMENINGEAL DEEP FASCIAL SPACE INFECTIONS: direct extension from sinusitis, otitis media, mastoiditis, petrous osteomyelitis; also odontogenic and following cranial surgery

Agents: *Bacteroides*, *Peptostreptococcus*, *Veillonella*, *Actinomyces*, *Fusobacterium*, microaerophilic *Streptococcus*, enteric Gram negative bacilli, *Pseudomonas aeruginosa* and *Staphylococcus aureus* in immunocompromised and otogenic infection

Diagnosis: ultrasonography, computerised axial tomography, blood cultures

Treatment:

Normal Patient:

Otogenic: benzylpenicillin 2-4 MU i.v. every 4-6 h or ciprofloxacin 0.4 g i.v. every 12 h + metronidazole 0.5 g i.v. every 6 h or chloramphenicol 0.5 g i.v. every 6 h

Rhinogenic/Odontogenic: benzylpenicillin 2-4 MU i.v. every 4-6 h + metronidazole 0.5 g i.v. every 6 h or chloramphenicol 0.5 g i.v. every 6 h

Following Cranial Surgery: flucloxacillin 1.5 g i.v. every 4-6 h + tobramycin 2 mg/kg i.v. every 8 h or ciprofloxacin 0.4 g i.v. every 12 h

Immunocompromised:

Otogenic/Rhinogenic/Odontogenic: cefotaxime 2 g i.v. every 6 h, ceftizoxime 4 g i.v. every 8 hours, imipenem 500 mg i.v. every 6 h

Following Cranial Surgery: vancomycin 0.5 g i.v. every 6 hours + cefotaxime, ceftizoxime or imipenem

MASTITIS AND BREAST ABSCESS

Agents: usually *Staphylococcus aureus* in acute; most commonly coagulase negative *Staphylococcus*, *Peptostreptococcus*, *Propionibacterium*, *Eubacterium* and *Bacteroides* in chronic; also α -haemolytic streptococci, *Streptococcus pyogenes*, microaerophilic streptococci, *Proteus*, *Escherichia coli*, *Prevotella disiens*, *Corynebacterium minutissimum* (1 case; recurrent) and others

Diagnosis: culture of pus swab, milk

Treatment:

Acute: di(flu)cloxacillin 500 mg orally 6 hourly for at least 5 d; cephalexin 500 mg orally 6 hourly for at least 5 d if penicillin hypersensitive (not immediate); clindamycin 400 mg orally 8 hourly for at least 5 d if immediate penicillin hypersensitivity; if severe cellulitis, di(flu)cloxacillin 2 g i.v. 6 hourly or cephalothin 2 g i.v. 6 hourly or cephazolin 2 g i.v. 8 hourly if penicillin hypersensitive (not immediate) or clindamycin 450 mg i.v. or orally 8 hourly or lincomycin 600 mg i.v. 8 hourly or vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g 12 hourly (monitor blood levels and adjust dose accordingly); prevention of milk stasis by suckling or expression manually or by pump; if no improvement in 2-3 d, surgical drainage

Chronic: amoxicillin-clavulanate or ampicillin-sulbactam; drainage with duct excision in advanced chronic
MYCETOMA (MADURA FOOT, MADUROMYCOSIS): 60% actinomycetoma (actinomycotic mycetoma) due to bacteria, 40% eumycetoma due to fungi; chronic progressive disease of skin, subcutaneous tissue and bone, usually arising secondary to trauma

Agents: *Nocardia asteroides*, *Nocardia brasiliensis*, *Nocardia caviae*, *Actinomadura madurae*, *Actinomadura pelletieri*, *Streptomyces somaliensis*, *Streptomyces paraguayensis*, *Actinomyces israelii*, *Pseudallescheria boydii*, *Aspergillus nidulans*, *Fusarium falciforme*, *Streptomyces recifensis*, *Neotestudina rosatii*, *Exophiala jeanselmei*, *Madurella mycetomatis*, *Streptomyces pseudoechinosporeus*, *Curvularia geniculata*, *Curvularia lunata*, *Leptosphaeria senegalensis*, *Pyrenochaeta romeroi*

Diagnosis: swelling and formation of granulomata, abscesses and deep sinuses; most characteristic feature presence of granules; brown to black grains produced by *Exophiala*, *Madurella*, *Curvularia*, *Leptosphaeria*, *Pyrenochaeta*, *Streptomyces paraguayensis*, yellow to brownish by *Streptomyces somaliensis*, bright red by *Actinomadura pelletieri*, white to yellowish by others; Gram stain, modified Ziehl-Neelsen stain and KOH preparation, bacterial and fungal culture (BHI and Sabaroud's at 30°C) of pus, curettings, biopsy or grains from draining sinuses; X-rays of affected part, and radionuclide scanning if negative, for underlying bone involvement

Treatment: surgery +:

Actinomycetes: penicillin

Nocardiforms: i.v. cotrimoxazole or dapsone + amikacin or streptomycin, penicillin, tetracycline, rifampicin

Fungi: may show some response to amphotericin B, flucytosine, ketoconazole, miconazole, itraconazole,

thiabendazole

BACTEREMIA, SEPTICEMIA, SEPTIC SHOCK: 1.8-13/1000 (13-15/1000 age > 60 y) hospital admissions; case-fatality rate 5-50% (5% in < 60 y, 22% in > 60 y); community acquired: 24% from respiratory tract, 23% urinary tract, 11% meningitis, 6% gastrointestinal tract, 6% cellulitis and decubitus, 3% bone and joint, 2% abdomen, 2% shunt; nosocomial: 18% from urinary tract, 17% hyperalimentation of intravenous site, 12% respiratory tract, 11% surgical wound, 8% abdomen, 8% gastrointestinal tract, 5% cellulitis and decubitus, 1% shunts; transient bacteremia characteristic of dental treatment; overflow bacteremia may be seen in patients with meningococcal meningitis, pneumonia, pyelonephritis; intermittent or constant bacteremia in infective endocarditis; 46% of bacteremic patients in long term care have cardiovascular disease

Agents: *Escherichia coli* (12-29% of total cases, 20-33% of community acquired, 12-18% of nosocomial, 13% of long term care; fifth most common organism in nosocomial infection in cancer patients; 24% of cases in leukemia, lymphoma, solid tumours; common in neutropenics (14%); case-fatality rate 25% in leukemia and lymphoma, 12% in solid tumours, 12% in nosocomial, 13% overall; 98-100% of isolates true infection; 96% clinically significant; 58% hospital acquired; 43-55% from genitourinary tract, 17% abscess, 15-16% unknown, 8-17% bowel, 8-15% hepatobiliary, 6% multiple, 4% wound, 2-11% respiratory; also neonatal), *Staphylococcus aureus* (10-30% of total cases, 9% of community acquired (25% of these associated with arteriosclerotic heart disease), 14% of nosocomial (80% of these associated with intravascular devices), 15% of long term care (5% methicillin resistant); second most common organism in cancer patients; 9% of cases in leukemia and lymphoma, 11% solid tumours; 57% in narcotic addicts (24% methicillin resistant); common in neutropenics (5%); case-fatality rate 14% in leukemia and lymphoma, 22% in solid tumours, 12% in nosocomial, 30% overall; 75-99% of isolates true infection; 94% clinically significant; 60% hospital acquired; 20-33% associated with intravenous catheters, 20-21% unknown, 11-16% from postoperative wounds, 7-29% from respiratory tract, 7% from skin infections, 7% from endocarditis, 7% from multiple, 6% from bone and joint; septicemia (staphylococcal pyaemia), with the presence of large numbers of multiplying staphylococci and of their toxic products in the bloodstream, may take a fulminant course and lead to septicemic adrenal haemorrhage syndrome), coagulase negative *Staphylococcus* (14% *Staphylococcus epidermidis*, 14% *Staphylococcus hominis*, 14% *Staphylococcus haemolyticus*, 6% *Staphylococcus warneri*, 5% of total cases, 3% of community acquired, 15% of nosocomial, 4% of long term care; common in neutropenics (14%; catheter-induced); most common organism in nosocomial infections in cancer patients; 11-37% case-fatality rate in nosocomial (septic shock in 22%), 25% overall; 56-94% of isolates contaminants; 20% significant; 31-68% from intravascular catheter, 19% wound, 16% multiple, 9% gastrointestinal tract, 4% bone and joint, 3-50% genitourinary tract, 3% endocarditis, 3% oropharyngeal, 0-50% CNS), *Streptococcus pneumoniae*

(50,000-63,000 cases/y in US; case rate 15-30/100,000 for adults and 50-83/100,000 for ≥ 65 y; 4-8% of total cases, 3% of long term care; all isolates true infection; 96% clinically significant; 81% community acquired; 85-94% from respiratory tract, 9% from meningitis; common in neutropenics; also in neonates; case-fatality rate 20% in adults, 60% in elderly; rare cases of hemorrhage and septic shock in infants; bacteremia without a focus of infection responsible for 70% of invasive pneumococcal disease in children < 2 y), *Klebsiella* (4-8% of total cases, 3% of community acquired, 3% of nosocomial, 1% of neonatal, 9% of long term care; eighth most common organism in nosocomial infections in cancer patients; 11% of cases in leukemia and lymphoma, 10% in solid tumours; common in neutropenics (19%); case-fatality rate 66% in leukemia and lymphoma, 29% in solid tumours, 28% in nosocomial, 27-34% overall; 99-100% of isolates true infection; 93% clinically significant; 80% hospital acquired; 24% multiple, 22% urinary tract, 20% unknown, 19% hepatobiliary, 12% gastrointestinal tract, 7-31% respiratory tract, 3-15% surgical wound, 3% oropharyngeal, 2-15% i.v. catheter), *Salmonella* (4% of community acquired, 2% of nosocomial; in renal transplant recipients and in AIDS; intermediate frequency in neutropenics; case-fatality rate 14% overall, 10% in nosocomial; all isolates true infection; all clinically significant; most common *Salmonella choleraesuis*, *Salmonella typhi* 1% of community acquired), *Pseudomonas* (3-6% of total cases; case-fatality rate 51%; 99-100% of isolates true infection; 95% clinically significant; 32-33% unknown source, 19% multiple, 18-23% genitourinary tract, 17% wound, 14-43% respiratory tract, 9% gastrointestinal tract, 8% hepatobiliary, 7% intravascular, 2% endocarditis; *Pseudomonas aeruginosa* 3% of community acquired, 12% of nosocomial, 5% of long term care; seventh most common organism in nosocomial infection in cancer patients; common in neutropenics (27%); 15% of cases in leukemia and lymphoma (case-fatality rate 54%); overall case-fatality rate 39%, 31% in nosocomial, 9% in narcotic addicts; 83% hospital acquired; *Pseudomonas alcaligenes* neonatal; other species (*Pseudomonas cepacia*, *Pseudomonas paucimobilis*, *Pseudomonas pickettii*) all hospital acquired, 42% from respiratory tract, 15% from genitourinary tract, 12% biliary; uncommon in neutropenics; case-fatality rate 31%; also *Shewanella putrefaciens* in patients with chronic infection of lower extremity or associated with severe underlying debility, liver disease, malignancy; *Burkholderia pseudomallei* common in Southeast Asia in rice farmers or their families, associated with diabetes and renal failure; case-fatality rate 85-95%), *Streptococcus pyogenes* (common in neutropenics, 0.5% of long term care; also chronic heart disease, malignancy and others; 4% of cases nosocomial; 72% from cutaneous or subcutaneous infections, 28% from i.v. drug abusers; 10% mixed infections) and other β -haemolytic streptococci (3-5% of total cases; 3% of cases in leukemia, lymphoma and solid tumours; 5% in neutropenics; case-fatality rate 20% in leukemia and lymphoma, 33% in solid tumours, 17% overall; 91-97% of isolates true infection; 92% clinically significant; 50% community acquired; 33% genitourinary tract, 10% bone and joint, 9-33% respiratory tract, 8-48% surgical wounds, 8% skin, 5% intravascular, 2-8% bowel, 2% endocarditis, 2% multiple, 2% meningitis; *Streptococcus canis* 0.8% of total cases (from cellulitis or abscess in patients with malignancies; 63% > 75 y; 80% men; 93% from skin or soft tissue infection), *Streptococcus agalactiae* in neonates (46% of cases) and also in hospitalised elderly patients with underlying disease, especially diabetes mellitus (4% of long term care; 19% from pneumonia, 19% from soft tissue infections, 11% from urinary tract infections, 8% from arthritis, 8% from osteomyelitis, 6% from lymphadenitis, 3% from meningitis, 3% from mastitis, 3% from ascending cholangitis, 3% from prostatitis); *Streptococcus milleri* from abscesses; Group C *Streptococcus* (*Streptococcus equisimilis*, *Streptococcus zooepidemicus*, *Streptococcus equi*) in cardiovascular disease and malignancy; 21% from respiratory tract, 18% gastrointestinal tract, 17% skin; case-fatality rate 25%), Group D streptococci (3-5% of total cases, 2% of community acquired, 3% of nosocomial, 1% of neonatal, 8% of long term care; case-fatality rate 32% overall, 7% in nosocomial; 87-99% of isolates true infection; 81% hospital acquired; 30% from wound, 22% multiple, 22% abscess, 12-22% genitourinary tract, 8-17% hepatobiliary, 6% gastrointestinal tract, 4% endocarditis, 2% pneumonia; *Enterococcus* common in neutropenics, in immunosuppression with debilitation, following instrumentation, after long term hospitalisation, and subsequent to use of cephalosporins; third most common organism in nosocomial infections in cancer patients; *Enterococcus avium* in gastrointestinal tract abnormalities; *Streptococcus equinus* indicator of possible colonic carcinoma and may cause such complications as endocarditis, spondylodiskitis, vertebral osteomyelitis and splenic abscess), *Streptococcus viridans* (41% *Streptococcus mitis*, 22% *Streptococcus sanguis*, 13% *Streptococcus morbillorum*, 7% *Streptococcus intermedius*, 7% *Streptococcus constellatus*, 2% *Streptococcus salivarius*, 2% *Streptococcus mutans*, 3-5% of all cases, 23% of neonatal; common in neutropenics; case-fatality rate 13%; 52-72% of isolates true infection; 31% clinically significant; 43% from respiratory tract, 29% from abscess, 17% unknown; predisposing factors epistaxis, bone marrow transplantation, treatment with cotrimoxazole, neutropenia), *Bacteroides* (2-6% of total cases, 2% of community acquired, 4% of nosocomial, 11% of neonatal; 11% of cases in solid tumours (case-fatality rate 4%); intermediate frequency in neutropenics; case-fatality rate in nosocomial 35%, overall 9-32%; all isolates true infection; 6-86% of isolates significant; 51% community acquired; 44% from gastrointestinal tract, 35% abscess, 20% wound, 12% hepatobiliary, 4-26% genitourinary tract, 4% bone and joint, 4% pneumonia; *Bacteroides fragilis* 70% of anaerobes isolated, involved in 62% of septicemia associated with infections of the female genital tract; 33% of isolates clinically significant; case-fatality rate 24%; other *Bacteroides* species 6-9% of

anaerobes isolated), *Serratia* (2-4% of total cases, 1% of community acquired, 2% of nosocomial, 1% of long term care; uncommon in neutropenics; 93-100% of isolates true infection; 98% clinically significant; 92% nosocomial; 35% multiple, 30-31% respiratory, 8% wound, 8% gastrointestinal tract, 4-30% genitourinary tract, 4% endocarditis, 4% hepatobiliary; case-fatality rate 18-54% overall, 40% in nosocomial), *Brucella* (2% of community acquired; all isolates true infection; septicemia due to *Brucella melitensis* is known as Bruce septicemia or melitensis septicemia), *Tsukamurella pulmonis* and *Tsukamurella tyrosinosolvans* immunosuppressed patients with indwelling venous catheters), *Candida* (1-4% of all cases, 6% of nosocomial, 1% of long term care; fourth most common organism in cancer patients; 5% in leukemia and lymphoma, 9% in solid tumours; case-fatality rate 72% in leukemia and lymphoma, 42% in solid tumours, 29% in nosocomial; *Candida albicans* 51% of fungal isolates, *Candida tropicalis* 13%, *Candida krusei* 9%, *Candida parapsilosis* 6%, *Candida guilliermondii* 6% (1% of catheter associated); *Candida lusitanae* 1% of catheter associated fungal, *Candida pseudotropicalis* 1%; 57% of *Candida tropicalis* isolates contaminants, all isolates of other species true infection; 93% clinically significant; 96% hospital acquired; 39% from i.v. cannula, 22% unknown source, 20% from gastrointestinal tract; largely in cancer patients receiving parenteral antimicrobials or alimentation; significant risk in patients with urological pathology undergoing surgery or manipulation; also in pregnancy, following abortion or postpartum), *Proteus* (1-3% of total cases, 4% of community acquired, 2% of nosocomial, 13% of long term care; intermediate frequency in neutropenics; 6% of cases in solid tumours (case-fatality rate 42%); overall case-fatality rate 20%, 8% in nosocomial; all isolates true infection; 93% clinically significant; 71% hospital acquired; 25-50% from genitourinary tract, 25% multiple, 17% abscess, 10% intravascular, 10% wound, 5-17% hepatobiliary, 0-17% respiratory tract), *Enterobacter* (1-3% of total cases, 1% of community acquired, 5-6% of nosocomial, 1% of long term care; intermediate frequency in neutropenics (11%); tenth most common organism in nosocomial infections in cancer patients; 85-100% of isolates true infection; 96% clinically significant; significant underlying conditions, including malignancy, in nearly all cases; 29% from wound, 19% multiple, 12% hepatobiliary tract, 7% intravascular catheter, 7% gastrointestinal tract, 5-33% genitourinary tract, 2-33% respiratory tract, 2% endocarditis; case-fatality rate 18-29% overall, 10% in nosocomial), *Clostridium* (1-2% of total cases, 2% of community acquired; intermediate frequency in neutropenics; 3% of cases in solid tumours (case-fatality rate 67%); overall case-fatality rate 43%; 28% of anaerobes isolated; 99-100% of isolates true infection; vast majority of cases follow septic abortion; also from gastrointestinal tract; *Clostridium perfringens* 6% of anaerobes isolated, 50% of isolates true infection, 10% of isolates clinically significant, 58% hospital acquired, case-fatality rate 43%; *Clostridium septicum* 2% of anaerobic isolates, 3% of isolates clinically significant, case-fatality rate 40%; *Clostridium oedematiens*, *Clostridium difficile* in immunocompromised; *Clostridium tertium* in neutropenics and aspiration pneumonia, 13% of anaerobes isolated), *Peptostreptococcus* (1% of total cases; common in neutropenics; 3% of anaerobes isolated; all isolates true infection; 3% of isolates clinically significant; 25% from surgical wound, 25% from urinary catheter, 25% from i.v. catheter, 25% biliary; case-fatality rate 9%), *Neisseria meningitidis* (meningococcal bacteraemia (meningococcaemia; 43% of meningococcal infections;) is a mild systemic disease which, on rare occasions, may become chronic; meningococcal septicemia (meningococcal fever; 5-20% of meningococcal infections) is a severe disease with large numbers of meningococci in bloodstream, usually accompanied by severe toxemia due to meningococcal endotoxins, but without disseminated intravascular coagulation and, as a rule, without meningitis, and which may be acute or chronic; incidence 0.2/100,000; 1% of community acquired; all isolates true infection; case-fatality rate 25%), *Haemophilus influenzae* (nontypeable strains; 0.7-4% of total cases, 1% of community acquired, 1% of nosocomial, 1% of neonatal, 0.5% of long term care; intermediate frequency in neutropenics; 94-100% of isolates true infection; 94% clinically significant; 60% community acquired; 100% from respiratory tract; clinical presentation in older children and adults: 52% pneumonia, 27% septicemia, 8% meningitis, 5% gynecologic infection, 5% epiglottitis; 31-36% mortality), diphtheroids (3% of isolates; 71% of isolates contaminants; 16% clinically significant), *Bacillus* (1% of total isolates; 91-94% of isolates contaminants; 4% clinically significant; in compromised; uncommon in neutropenics; usually *Bacillus cereus*; *Bacillus anthracis* marked toxic effects), *Neisseria* species other than *Neisseria meningitidis* and *Neisseria gonorrhoeae* (0.5% of isolates; 33% contaminants; 50% clinically significant; *Neisseria cinerea*, *Neisseria flavescens*, *Neisseria lactamica*, *Neisseria subflava*; uncommon in neutropenics and other immunodeficient), *Peptococcus* (0.4% of isolates; 88% of isolates true infection; 78% clinically significant; mainly obstetrical patients during peripartum period; also 1% of neonatal cases; uncommon in neutropenics), *Fusobacterium* (0.3% of isolates, 9% of anaerobic isolates; 50% clinically significant, 50% transient bacteremia; intermediate frequency in neutropenics; *Fusobacterium necrophorum* all isolates true infection; 33% from genitourinary tract, 33% respiratory, 33% abscess; 1% of neonatal cases; intermediate frequency in neutropenics), *Citrobacter* (0.3% of isolates; all isolates clinically significant; uncommon in neutropenics; 0.5% of long term care; case-fatality rate 17%), *Listeria monocytogenes* (0.2% of isolates; all isolates true infection; 75% clinically significant; 57% community acquired; 60% from CNS; 4% of neonatal cases; uncommon in neutropenics), *Campylobacter* (0.1% of all isolates; all isolates clinically significant; *Campylobacter fetus* subsp *fetus*, *Campylobacter jejuni* (in conjunction with gastroenteritis in people at extremes of age or

with cirrhosis, diabetes, renal failure, cancer, HIV), *Campylobacter coli*, *Campylobacter upsaliensis*, *Campylobacter lari*, *Arcobacter butzleri*, *Capnocytophaga* (0.1% of isolates; all clinically significant; especially with oral mucositis; uncommon in neutropenics; *Capnocytophaga canimorsus* in hemochromatosis, asplenia or alcoholism following dog or cat bite), *Moraxella* (0.1% of isolates; 33% contaminants, 67% transient bacteraemia; uncommon in neutropenics; *Moraxella catarrhalis* rare in immunodeficient; *Moraxella osloensis*), *Providencia* (0.1% of isolates; all isolates clinically significant; uncommon in neutropenics; case-fatality rate 9%; *Providencia stuartii* 13% of long term care; *Providencia rettgeri* 0.5% of long term care), *Eubacterium lentum* (0.08% of isolates; 50% contaminants, 50% clinically significant), *Haemophilus aegyptius* (Brazilian purpuric fever), *Haemophilus aphrophilus*, *Chromobacterium violaceum* (acute septicemia associated with abscesses in multiple organs; uncommon in neutropenics), *Yersinia pestis*, *Yersinia enterocolitica* (in iron overload cirrhosis; uncommon in neutropenics), *Mycoplasma hominis* (6% of neonatal cases), *Ureaplasma urealyticum* (1% of neonatal cases, puerperal), *Mycobacterium fortuitum* and *Mycobacterium chelonae* (catheter related), *Vibrio vulnificus* (elevated iron due to hemochromatosis or alcoholism), *Vibrio metschnikovii*, *Vibrio cholerae* non-01 (in cirrhosis and leukemia), *Vibrio cincinnatii*, *Vibrio hollisae* and *Vibrio parahaemolyticus* (following ingestion of seafood), *Flavobacterium meningosepticum* (in leukemia; uncommon in neutropenics), *Aeromonas* (uncommon in neutropenics; *Aeromonas hydrophila* ≈ 50% case-fatality rate in immunocompromised), *Alcaligenes* (uncommon in neutropenics; *Alcaligenes xylosoxidans xylosoxidans* rare catheter related and gastrointestinal, especially in cancer patients), *Francisella tularensis*, *Kingella kingae* (mainly children; uncommon in neutropenics), *Anaerobiospirillum succiniciproducens*, *Corynebacterium* (27% of isolates contaminants; *Corynebacterium jeikeium* 90% catheter related; *Corynebacterium urealyticum* in immunosuppressed; *Corynebacterium striatum* in immunocompromised or anatomically altered patients), *Staphylococcus saprophyticus* (rare cases associated with sexual intercourse and/or urinary obstruction), *Leuconostoc* (rare cases associated with parenteral nutrition, other catheters and previous antibiotic therapy), *Oerskovia* (catheter related), *Propionibacterium acnes* (associated with foreign body; intermediate frequency in neutropenics; 33% of anaerobic isolates; 3% of isolates clinically significant; case-fatality rate 45%), *Gardnerella vaginalis* (obstetric patients, rarely from prostate in males; uncommon in neutropenics), *Zymomonas* (uncommon in neutropenics), *Legionella* (uncommon in neutropenics), *Eikenella corrodens* (uncommon in neutropenics), *Acinetobacter* (uncommon in neutropenics; *Acinetobacter baumannii* nosocomial; *Acinetobacter johnsonii* vascular catheter related), *Shigella* (uncommon in neutropenics), *Erwinia* (uncommon in neutropenics), *Hafnia* (uncommon in neutropenics), *Edwardsiella tarda* (exposure to aquatic environments or exotic animals, preexisting liver disease, iron overload, raw fish ingestion; uncommon in neutropenics), *Morganella* (uncommon in neutropenics; 3% of long term care), *Actinobacillus* (uncommon in neutropenics; *Actinobacillus actinomycetemcomitans* also associated with oral infection), *Veillonella* (uncommon in immunocompromised), *Pediococcus acidilacti* (severely compromised), *Neisseria gonorrhoeae*, *Erysipelothrix rhusiopathiae*, *Actinomyces israelii* (usually from pulmonary actinomycosis), *Stenotrophomonas maltophilia* (0.5% of long term care; nosocomial infection in immunocompromised patients receiving broad spectrum antimicrobials), *Leptotrichia buccalis* (in cancer patients), *Pseudomonas luteola* and *Pseudomonas oryzihabitans* (prosthetic materials, corticosteroids), *Rothia mucilaginosa* (i.v. drug abuse, cardiac valve disease, vascular catheters, immunocompromised), *Ochrobacterium anthropi* (catheter associated), *Methylobacterium extorquens* (catheter related), *Agrobacterium tumefaciens* (intravascular catheter), *Prevotella melaninogenica* (8% of septicemia associated with female genital tract infection), *Sphingobacterium multivorum* (haemodialysis, lymphoma), *Weeksella virosa* (postsurgical), *Plesiomonas shigelloides* (secondary to cellulitis and prostatitis), *Pasteurella multocida* (following pneumonia), *Helicobacter cinaedi* and *Helicobacter fennelliae* (in homosexual men), *Cardiobacterium hominis*, *Succinivibrio dextrinosolvens* (rare cases associated with gastrointestinal or oesophageal sepsis), *Ochrobacterium anthropi* (patients on haemodialysis), *Brevibacterium casei* (associated with Hickmann catheter in AIDS), *Bartonella quintana* (homeless), *Bartonella bacilliformis* (Oroya fever), *Candida glabrata* (solid tumours and nononcologic; 13% of fungal isolates; 4% of catheter associated), *Malassezia furfur* and *Malassezia pachydermatis* (patients receiving i.v. fat emulsions; 1% of catheter associated fungemia in cancer patients), *Saccharomyces cerevisiae* (1% of catheter associated fungemia in cancer patients), *Trichosporon*, *Fusarium*, *Rhodotorula rubra* and *Pichia* in cancer patients; 6-14% of cases polymicrobial (82% hospital acquired; 74% severe underlying illness; case-fatality rate 21->50%)

Diagnosis: blood cultures; counterimmunoelectrophoresis of serum; white cell count 4,300-11,400 (mean 8160/ μ L), neutrophils 24-83% (mean 61%), shift to left with 5-56% (mean 25%) bands, toxic granulation, lymphocytes 5-17% (mean 10%), monocytes 0-6% (mean 3%), eosinophils 0-35% (mean 1%), basophils 0-1% (mean 1%); fibrin degradation products normal or elevated (significant elevation in 70% of cases), daily estimations may indicate patient's progress; platelet aggregation normal in 30-50% of cases; platelet count 90,000-468,000/ μ L; infarction, Addisonian crisis (extremely rare) may simulate

Gram Negative: increasing age, underlying medical condition, surgery or trauma, invasive diagnostic procedures, mechanical ventilatory support, antimicrobial treatment, immunosuppressive agents, vascular or bladder

indwelling catheters; fever in 90-95%, change in mental status in 60-70%, increased respiratory rate in 50-60%, chills in 50%, hypotension in 40-60%, oliguria in 30-50%, bleeding from needle-sticks or mucosal surfaces in 7-10%, hypothermia in 5-10%, skin lesions in 5-10%; positive blood cultures in 100%, leucocytosis in 85-90%, acidosis in 50-80%, elevated blood urea nitrogen and/or creatinine in 50-80%, thrombocytopenia in 50-60%, abnormal liver function tests in 20-30%, leucopenia in 10-15%

Brazilian Purpuric Fever: child 3 mo - 1 y, acute febrile illness, abdominal pain or vomiting, hemorrhagic skin lesions, history of conjunctivitis in 30 d preceding fever, no evidence of meningitis

Gonococcal Septicemia: often fever and rigours

Meningococcal Septicemia: retinal haemorrhages common

Septicemia Due to *Clostridium*: high fever, extensive intravascular haemolysis, acute renal tubular necrosis; usually fatal

Listerial (Listeric) Septicemia: usually predominant involvement of liver

***Erysipelothrix rhusiopathiae* Septicemia:** fever, generalised myalgia, anorexia, weight loss; often results in endocarditis

Neonatal: absence of specific antibodies, polymorphonuclear dysfunction, decreased complement, prematurity, prolonged rupture of membranes, complicated delivery, maternal infection, ventilatory support equipment, intravascular monitoring devices, bladder catheters; temperature may be normal or low (elevated in only 40%), evidence of respiratory distress including apnoea, poor feeding, jaundice; leucopenia with increased percentage of band forms; positive cultures

Anthrax: Gram stain, India ink stain and culture of blood; ELISA, Western blot, toxin detection, chromatographic assay, fluorescent antibody test

***Bacillus cereus*:** diarrhoea, fever, altered mental status; Gram stain and culture of blood

***Brucella*:** acute or insidious onset with continued, intermittent or irregular fever of variable duration, profuse sweating particularly at night, fatigue, anorexia, weight loss, headache, arthralgia, generalised aching; isolation; *Brucella* tube agglutination titre on serum > 160; ELISA (IgA, IgG, IgM), 2-mercaptoethanol test, complement fixation test, Coombs, fluorescent antibody test, antipolysaccharide antibody radioimmunoassay, counterimmunoelectrophoresis

Treatment: volume repletion (including colloids), rapidly infused; oxygen under pressure if necessary; vasopressor amines in elderly patients with coronary insufficiency and normal central venous pressure; ? polymyxin B in Gram negative; monitor blood glucose

Infection From Female Genital Tract: amoxy(ampi)cillin 2 g i.v. 6 hourly + gentamicin 4-6 mg/kg i.v. as single daily dose + metronidazole 500 mg i.v. 12 hourly or 1 g rectally 8 hourly

Penicillin Hypersensitive (Not Immediate), Sexually Acquired: doxycycline 100 mg orally or i.v. 12 hourly + cefoxitin 2 g i.v. 8 hourly, doxycycline 100 mg orally or i.v. 12 hourly + metronidazole 500 mg i.v. 12 hourly + ceftriaxone 1 g i.v. daily or cefotaxime 1 g i.v. 8 hourly

Immediate Penicillin Hypersensitivity, Postpartum: gentamicin 4-6 mg/kg as single daily dose (adjust dose for renal function) + clindamycin 600 mg i.v. slowly 8 hourly or lincomycin 600 mg i.v. 8 hourly

Elderly, Diminished Renal Function: cefotaxime 1 g i.v. 8 hourly or ceftriaxone 1 g once daily + metronidazole as above; piperacillin-tazobactam 4/0.5 g i.v. 8 hourly or ticarcillin-clavulanate 3/0.1 g i.v. 6 hourly

Infection from Respiratory System:

Adults: erythromycin 0.5-1 g i.v. slowly 6 hourly + cefotaxime 1 g i.v. 8 hourly or ceftriaxone 1 g i.v. once daily or benzylpenicillin 1.2 g i.v. 4-6 hourly + gentamicin 5-7 mg/kg i.v. daily

Children: di(fluc)loxacin 50 mg/kg to 2 g i.v. 6 hourly + cefotaxime 50 mg/kg to 2 g i.v. 6-8 hourly or ceftriaxone 50 mg/kg to 2 g i.v. once daily or chloramphenicol 75 mg/kg/d to 3 g/d i.v. in 3 divided doses

Focus Probably Biliary or Gastrointestinal Tract (Including Ascending Cholangitis): gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. as single daily dose (adjust dose for renal function) + metronidazole 12.5 mg/kg to 500 mg i.v. infused over 20 min 12 hourly or 1 g (< 12 y: 500 mg) rectally 8-12 hourly + amoxy(ampi)cillin 50 mg/kg to 2 g i.v. 6 hourly; clindamycin 600 mg i.v. 8 hourly (child > 1 mo: 15-40 mg/kg daily in divided doses) + gentamicin as above; when afebrile, change to amoxycillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally for total of 7 d

Elderly Patients With Diminished Renal Function, Significantly Elevated Serum Creatinine or Other Contraindication to Gentamicin: piperacillin-tazobactam 100/12.5 mg/kg to 4/0.5 g i.v. 8 hourly or ticarcillin-clavulanate 50/1.7 mg/kg to 3/0.1 g i.v. 6 hourly

Penicillin Hypersensitive (Not Immediate): metronidazole 12.5 mg/kg to 500 mg i.v. 12 hourly + ceftriaxone 25 mg/kg to 1 g i.v. once daily or cefotaxime 25 mg/kg to 1 g i.v. 8 hourly

Immediate Penicillin Hypersensitivity: substitute vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly) for amoxy/ampicillin

Focus Probably Urinary Tract: amoxy(ampi)cillin 50 mg/kg to 2 g i.v. 6 hourly + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. as single daily dose (adjust dose for renal function)

Penicillin Hypersensitive: gentamicin alone

Aminoglycoside Contraindicated: ceftriaxone 50 mg/kg to 1 g i.v. once daily, cefotaxime 50 mg/kg to 1 g i.v. 8 hourly

Focus Probably Open Skin Infection/Cellulitis: di(flu)cloxacillin 50 mg/kg to 2 g i.v. 6 hourly; if penicillin hypersensitive, cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephazolin 50 mg/kg to 2 g i.v. 8 hourly if not immediate, or clindamycin 10 mg/kg to 450 mg i.v. or orally 8 hourly or lincomycin 15 mg/kg to 600 mg i.v. 8 hourly or vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly)

Children < 4 y with Facial or Periorbital Cellulitis: as above + cefotaxime 50 mg/kg to 2 g i.v. 8 hourly or ceftriaxone 50 mg/kg to 2 g once daily or chloramphenicol 75 mg/kg/d to maximum 3 g/d i.v. in 3 divided doses

Focus Probably Decubitus or Ischaemic Ulcer or Diabetic Foot Infection: surgical debridement of necrotic tissue; piperacillin + tazobactam 4 + 0.5 g i.v. 8 hourly, ticarcillin-clavulanate 3/0.1 g i.v. 6 hourly, meropenem 500 mg i.v. 8 hourly; if penicillin hypersensitive, ciprofloxacin 400 mg i.v. or 750 mg orally 12 hourly + clindamycin 900 mg i.v. 8 hourly by slow infusion or lincomycin 900 mg i.v. 8 hourly by slow infusion

Focus Probably Intravascular Device (Including Central Venous Lines): remove and culture cannula; di(flu)cloxacillin 50 mg/kg to 2 g i.v. 6 hourly for 2 w + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) as single daily dose (adjust dose for renal function)

Penicillin Hypersensitive (Not Immediate): substitute cephalothin 50 mg/kg to 2 g i.v. 6 hourly or cephazolin 50 mg/kg to 2 g i.v. 8 hourly for di/flucloxacillin

Immediate Penicillin Hypersensitivity or MRSA a Possibility: substitute vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. slowly 12 hourly (monitor blood levels and adjust dose accordingly) for di/flucloxacillin

Elderly, Diminished Renal Function: flucloxacillin + cefotaxime 1-2 g i.v. 8 hourly or ceftriaxone 1-2 g i.v. once daily

Unidentified Source:

Normal Adult: gentamicin 4-6 mg/kg i.v. as single daily dose (adjust dose for renal function) + di(flu)cloxacillin 2 g i.v. 4-6 hourly or (if non-immediate penicillin hypersensitivity) cephalothin 2 g i.v. 6 hourly or cephazolin 2 g i.v. 8 hourly or (immediate penicillin hypersensitivity) vancomycin 25 mg/kg to 1 g i.v. by slow infusion 12 hourly (monitor blood levels and adjust dose accordingly)

Child:

Meningitis Not Excluded:

< 6 mo: amoxy/ampicillin 50 mg/kg i.v. 6 hourly + cefotaxime 50 mg/kg i.v. 6 hourly + (if pneumococcal meningitis likely) vancomycin 15 mg/kg i.v. 6 hourly by slow infusion (monitor blood levels and adjust dose accordingly)

> 6 mo: di/flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly + cefotaxime 50 mg/kg to 2 g i.v. 6 hourly or ceftriaxone 100 mg/kg to 4 g i.v. daily or 50 mg/kg to 2 g i.v. 12 hourly + (if pneumococcal meningitis is likely) vancomycin 15 mg/kg to 500 mg i.v. 6 hourly by slow infusion (monitor blood levels and adjust dose accordingly)

Meningitis Excluded:

< 4 mo: amoxy/ampicillin 50 mg/kg i.v. 6 hourly + gentamicin 7.5 mg/kg i.v. daily (adjust dose for renal function)

> 4 mo: di(flu)cloxacillin 50 mg/kg to 2 g i.v. 6 hourly + cefotaxime 25 mg/kg to 1 g i.v. 6 hourly or ceftriaxone 25 mg/kg to 1 g i.v. daily

Febrile Neutropenic Patients: ceftazidime 50 mg/kg to 2 g i.v. 8 hourly, piperacillin + tazobactam 100 + 12.5 mg/kg to 4 + 0.5 g i.v. 8 hourly, gentamicin 4-6 mg/kg (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg) i.v. daily (adjust dose for renal function) + ticarcillin-clavulanate 50/1.7 mg/kg to 3/0.1 g i.v. 6 hourly; + (if Gram positive organism resistant to other agents isolated or clinical progression) vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly by slow infusion (monitor blood levels and adjust dose accordingly)

In every case, institute appropriate specific therapy as soon as laboratory results are available:

Salmonella: amoxicillin 1 g i.v. 6 hourly (< 20 kg: 25-50 mg/kg daily in divided doses), chloramphenicol 500 mg orally 6 hourly (child > 2 w: 50 mg/kg/d orally in 4 divided doses; premature, newborn and those with immature metabolism: 25 mg/kg/d in 4 divided doses), cotrimoxazole 160/800 mg i.v. or orally (6 w - 5 mo: 20/100 mg i.v.; 6 mo - 5 y: 40/200 mg i.v.; 6-12 y: 80/400 mg) 12 hourly (severe infection in child: 6/30 mg/kg i.v. daily in 2 divided doses), ofloxacin

Shigella: ampicillin 200 mg/kg i.v. in divided doses daily ± gentamicin 1.3 mg/kg i.v. 8 hourly

Other Gram Negative Enteric Bacteria: gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. daily (adjust dose for renal function), ceftriaxone 50 mg/kg to 1 g i.v. daily, cefotaxime 50 mg/kg to 1 g i.v. 8 hourly

Staphylococci: careful investigation to determine if associated endovascular or metastatic focus

Penicillin Susceptible *Staphylococcus aureus*: benzylpenicillin 45 mg/kg to 1.8 g i.v. 4 hourly

Penicillin Resistant Methicillin Susceptible *Staphylococcus aureus*: di(flucloxacillin) 50 mg/kg to 2 g i.v. 6 hourly

Penicillin Hypersensitive (Not Immediate): cephalothin 50 mg/kg to 2 g i.v. 6 hourly, cephalosolin 50 mg/kg to 2 g i.v. 8 hourly

Methicillin Resistant *Staphylococcus aureus*, Coagulase Negative Staphylococci, Immediate Penicillin Hypersensitivity: vancomycin 25 mg/kg (< 12 y: 30 mg/kg) to 1 g i.v. 12 hourly over 60 min (monitor blood levels and adjust dose accordingly)

***Streptococcus pneumoniae*:** broad spectrum cephalosporin + vancomycin until sensitivities available

***Burkholderia pseudomallei*:** cotrimoxazole + ceftazidime or meropenem or imipenem

***Anaerobiospirillum succiniciproducens*:** cephmandole 1 g every 8 h

***Neisseria meningitidis*:** i.v. fluids, oxygen and ventilation support, inotropic agents if fluid resuscitation unsuccessful, dexamethasone 0.6 mg/kg/d in 4 divided doses if cerebral edema and increased intracranial pressure; activated protein C; benzylpenicillin (< 1 y: 300 mg; 1-9 y: 600 mg; ≥ 10 y: 1200 mg) i.v. or i.m. before hospital transfer, then 45 mg/kg to 1.8 g i.v. 4 hourly for 3-5 d

Penicillin Hypersensitive (Not Immediate) or Remote Areas: ceftriaxone 50 mg/kg to 2 g i.v. immediately, then ceftriaxone 100 mg/kg to 4 g i.v. daily, 50 mg/kg to 2 g i.v. 12 hourly for 3-5 d or cefotaxime 50 mg/kg to 2 g i.v. 6 hourly for 3-5 d

***Capnocytophaga canimorsus*, *Leptotrichia buccalis*:** penicillin

***Pseudomonas aeruginosa*:** ticarcillin-clavulanate 50/1.7 mg/kg to 3/0.1 g 4 hourly + gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) i.v. as single daily dose

Penicillin Hypersensitive (Not Immediate Hypersensitivity): ceftazidime 50 mg/kg to 2 g i.v. 8 hourly by infusion over 30 minutes or cefepime 50 mg/kg to 2 g i.v. 12 hourly or ceftipime 50 mg/kg to 2 g i.v. 12 hourly + gentamicin as above

Immediate Penicillin Hypersensitivity: ciprofloxacin 10 mg/kg to 400 mg i.v. 12 hourly + gentamicin as above

***Burkholderia cepacia*:** imipenem

***Alcaligenes xyloxydans*:** cotrimoxazole, ciprofloxacin

***Leuconostoc*:** high dose penicillin, clindamycin; removal of intravascular catheters when appropriate

***Oerskovia*:** ampicillin + cotrimoxazole

***Bacillus*, *Rothia mucilaginosa*, *Corynebacterium jeikeium*, *Corynebacterium striatum*, *Corynebacterium urealyticum*:** vancomycin 500 mg i.v. over 60 minutes 6 hourly (child: 44 mg/kg i.v. daily in divided doses over 60 minutes) + carbapenem

***Yersinia enterocolitica*, *Campylobacter fetus* subsp *fetus*, *Methylobacterium extorquens*, *Agrobacterium tumefaciens*:** gentamicin 1.3 mg/kg (child 1.5-2.5 mg/kg) i.v. 8 hourly ± amoxicillin-clavulanate, piperacillin, cotrimoxazole, rifampicin, fluoroquinolone

Other *Campylobacter*: ciprofloxacin

***Stenotrophomonas maltophilia*, *Ochrobacterium antropi*:** cotrimoxazole

***Acinetobacter*:** colistimethate sodium 2.5 mg/kg to 300 mg i.v. 12 hourly

***Enterococcus*:** ampicillin + gentamicin (streptomycin if high level resistance to gentamicin and streptomycin susceptible); vancomycin

Vibrio: doxycycline 100 mg orally or i.v. twice daily + ceftazidime 2 g i.v. 3 times a day or ciprofloxacin 400 mg twice a day for 3 d or gentamicin

Candida albicans: fluconazole 10 mg/kg to 400 mg i.v. once daily till clinical improvement, then 10 mg/kg to 400 mg orally daily to complete total of at least 2 w

Other Fungi: catheter removal + amphotericin B desoxycholate 0.5-1 mg/kg in glucose 5% i.v. infusion (preferably through a central line) slowly over 2-6 h (following test dose) once daily till clinical improvement then fluconazole 10 mg/kg to 400 mg orally daily for at least 14 d or (*Candida krusei*, *Candida glabrata*) voriconazole or caspofungin

Prophylaxis:

Post-Splenectomy: asplenic children and children with sickle cell anemia < 5 y, first 2 y following splenectomy, patients with severe underlying immunosuppression

< 24 mo Old: amoxicillin 20 mg/kg orally once daily, phenoxymethylpenicillin 125 mg orally twice daily

> 2 y Old: amoxicillin 250 mg orally once daily, phenoxymethylpenicillin 250 mg orally 12 hourly

Penicillin Hypersensitive: roxithromycin 4 mg/kg to 150 mg orally once daily, erythromycin 250 mg orally once daily, erythromycin ethyl succinate 400 mg orally daily

Neisseria meningitidis: ceftriaxone 250 mg (< 15 y: 125 mg) i.m. as single dose (preferred if pregnant), ciprofloxacin 500 mg orally as single dose (not < 12 y; preferred for women taking oral contraceptive), rifampicin 10 mg/kg (< 1 mo: 5 mg/kg) to 600 mg orally 12 hourly for 2 d (not pregnant, alcoholic, severe liver disease; preferred for children); vaccines (quadrivalent polysaccharide, quadrivalent conjugate, and serogroup conjugate) available

Cirrhotic Patient with Gastrointestinal Bleeding: norfloxacin 400 mg orally commencing 1 h before endoscopy and then 12 hourly for 1-2 d or if oral therapy not feasible ciprofloxacin 400 mg i.v. at time of induction and then 12 hourly for 1-2 d

Streptococcus pneumoniae: pneumococcal polysaccharide vaccine recommended to adults ≥ 65 y, individuals > 2 y with chronic illness, anatomic or functional asplenia, immunocompromise (disease, chemotherapy, steroids), HIV infection, environment or settings with increased risk, or cochlear implants; pain, swelling and redness at injection site in 30-50%, fever and muscle aches in < 1%, rare severe reactions; revaccination after 5 y for ≥ 2 y with functional or anatomic asplenia, immunosuppression, malignancy, transplant, chronic renal failure, nephritic syndrome, HIV infection, chronic systemic steroids, or < 65 y at time of first vaccination; pneumococcal conjugate vaccine recommended for routine vaccination of children < 24 mo and 24-59 mo with high risk medical conditions; pain, swelling and redness at injection site in 10-20%; reduces invasive disease due to serotypes in the vaccine by 97% and to those not in the vaccine by 89%

SEPTICEMIC ADRENAL HEMORRHAGE SYNDROME (ADRENAL HEMORRHAGE SYNDROME, SEPSIS ACUTISSIMA HYPERERGICA FULMINANS, SEPTICEMIC ADRENAL HEMORRHAGE): fulminating, usually fatal, form of septicemia; mechanism not clearly understood

Agent: usually *Neisseria meningitidis* (fulminating purpuric meningococemia, Marchand-Waterhouse-Freiderichsen syndrome, meningococcal hemorrhagic adrenalitis, meningococcal adrenal syndrome, Waterhouse-Freiderichsen syndrome); also *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Staphylococcus*, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, several members of Enterobacteriaceae

Diagnosis: sudden onset of fever, chills, myalgia, vomiting, headache, cyanosis/hemorrhage of skin and mucous membranes, bilateral adrenal hemorrhage, disseminated intravascular coagulation and shock; blood cultures

Treatment: supportive; antimicrobials depending on agent

SUBACUTE FEBRILE DISEASE

Agents: streptococci (mainly *Streptococcus viridans*), any bacterium

Diagnosis: blood cultures

Treatment: dependent on isolate

CHRONIC AND SUB-ACUTE FEVER

Agents: *Candida albicans*, *Candida lusitanae* (in immunocompromised), *Cryptococcus neoformans*, *Histoplasma capsulatum*

Diagnosis: blood cultures (DuPont Isolator, Bactec); moderate anemia (normochromic normocytic becoming hypochromic); raised ESR

Treatment: amphotericin B 0.75 mg/kg i.v. daily for 2-4 w ± flucytosine 25 mg/kg i.v. or orally 6 hourly for 2 w; fluconazole 800 mg/kg orally or i.v. initially, then 400 mg daily

SWEATING DISEASE (MILIARY FEVER, SWEATING SICKNESS): acute febrile infectious disease; no reference in literature during past 25 years

Agent: ? *Chlamydia*

Diagnosis: profuse sweating and formation of numerous papules

Treatment: presumably, doxycycline or erythromycin

PSEUDOBACTEREMIA: 11% of nosocomial epidemics; 55% contaminated during specimen collection, handling and processing (non-sterile blood collection tubes, cross contamination by obtaining blood culture and other specimens from same venipuncture, contaminated skin preparation material, contaminated blood culture tube holders, contaminated commercial culture media, contaminated commercial radiometric analyser, contaminated tincture of thiomersal used to sterilise blood culture bottle tops, inadequately sterilised integral stoppers, other contaminated equipment, disinfectants and vascular catheters)

Agents: variety of organisms, including *Aerococcus viridans*, *Burkholderia cepacia*, *Stenotrophomonas maltophilia*

TRANSFUSION REACTIONS DUE TO BACTERIAL CONTAMINATION OF BLOOD AND BLOOD PRODUCTS: mortality 35%

Agents: wide range of bacteria, most commonly *Pseudomonas fluorescens* and other *Pseudomonas* species

Diagnosis: 80% fever, 53% chills, 37% hypotension, 26% nausea/vomiting; smear and culture of transfused product at 4°C, 25°C and 35°C; culture of patient's blood

Treatment: antimicrobials as suggested by smear

ENDOTOXINEMIA

Agents: *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterobacter agglomerans*

Diagnosis: fever, chills; limulus test, SimpliRED endotoxin agglutination test

Treatment: supportive; removal of contaminated equipment (eg, hemodialysis); polymyxin B

TOXIC SHOCK SYNDROME (TAMPON DISEASE, TSS): a characteristic generalised toxemia associated with toxin production at a carrier site (including, notably, the vagina) or in a local lesion; case-fatality rate 3%

Agent: toxin-producing strains of *Staphylococcus aureus*; associated with tampons, barrier contraceptives, postpartum, surgical wound infections, focal staphylococcal infections, nasal surgery, sinusitis, influenza in children; also due to *Streptococcus pyogenes* (mainly associated with cellulitis, varicella and use of non-steroidal antiinflammatory drugs); cases due to *Campylobacter intestinalis*, *Streptococcus agalactiae* and *Streptococcus canis* reported

Diagnosis:

Staphylococcal: fever > 38.9°C in all cases; generalised scarlatiniform (diffuse macular erythematous) skin rash in all cases; mild skin desquamation (particularly of palms and soles) in convalescence (1-2 w after onset of illness) in all cases; hypotension, tachycardia, myocarditis, pericarditis, tachyarrhythmia in 91-95%; diarrhoea or vomiting at onset of illness, ileus, melena, hepatomegaly, hepatic necrosis, acute pancreatitis, acute abdomen in 42-62%; disorientation, meningismus, coma, seizure, cerebral edema in 24-50%; profound myalgia or arthralgia lasting > 5 d in 25-52%; tachypnoea, pleural effusion, pleural edema, acute respiratory distress syndrome in 24-33%; pharyngitis or conjunctivitis lasting > 5 d, strawberry tongue in 21-29%; oliguria, azotemia, acute tubular necrosis, acute renal failure in 0-17%; vaginal, oropharyngeal, conjunctival hyperemia, vulvar edema; late sequelae: nail or hair loss, delayed venous capillary filling in 45-56%, impaired memory or concentration, ataxia, dysarthria in 38-67%, neuromyasthenia, chronic fatigue in 33-54%, menstrual irregularity, menorrhagia, dysmenorrhoea in 25-31%, cardiomyopathy, congestive heart failure, recurrent syncope in 0-23%, chronic diarrhoea, weight loss, anorexia; electrocardiogram (decreased voltage and ST-T wave changes in 20% of cases, new gallop rhythms in 5%); elevated blood urea nitrogen ($\geq 2X$ upper limit normal in 52% of cases), serum creatinine ($\geq 2X$ ULN in 52%), bilirubin ($\geq 1.5X$ ULN in 54%), creatine phosphokinase ($\geq 2X$ ULN in 59%), SGOT ($\geq 2X$ ULN in 42%), SGPT ($\geq 2X$ ULN in 42%); white cell count with marked left shift, platelet count low in first week ($\leq 100,000/\mu\text{L}$ in 42%), usually high in second week ($\geq 400,000/\mu\text{L}$ in 27%); urinalysis (≥ 5 leucocytes/hpf, ≥ 1 erythrocyte/hpf and protein $\geq 1+$ in 88%); isolation of *Staphylococcus aureus* from cervical or vaginal swabs confirmatory but never diagnostic; tests for toxin production not suitable for routine laboratory use; negative tests for blood (bacteremia in < 3%), throat, CSF cultures and serological tests for Rocky Mountain spotted fever, leptospirosis and measles

Streptococcal: severe pain, fever, shock, hypotension, renal impairment, coagulopathy, liver involvement, adult respiratory disease, generalised erythematous rash (less likely), soft tissue necrosis; blood cultures positive in 60%

Differential Diagnosis: mild forms of toxic epidermal necrolysis (absence of Nikolsky's sign in TSS), Kawasaki syndrome, staphylococcal scarlet fever (skin biopsy, serologic evidence of exfoliatin), streptococcal scarlet fever (ASOT), Rocky Mountain spotted fever (petechial rash), leptospirosis, meningococemia (petechial or purpuric rash), Stevens-Johnson syndrome

Treatment:

Staphylococcus aureus: remove tampon; administer fluid replacement therapy; search for possible sites of infection (culture from vagina, oropharynx, conjunctiva, wounds, blood and urine)

Methicillin Sensitive: di/flucloxacillin 50 mg/kg to 2 g i.v. 6 hourly

Penicillin Hypersensitive (Not Immediate): cephalothin 50 mg/kg to 2 g i.v. 6 hourly, cephalozin 50 mg/kg to 2 g i.v. 8 hourly

Methicillin Resistant, Immediate Penicillin Hypersensitivity: vancomycin 500 mg i.v. 6 hourly over 60 minutes (child: 44 mg/kg i.v. daily in divided doses)

Streptococci: benzylpenicillin 45 mg/kg to 1.8 g i.v. 4 hourly + clindamycin 15 mg/kg to 600 mg i.v. 8 hourly
or lincomycin 15 mg/kg to 600 mg i.v. 8 hourly; normal immunoglobulin 0.4-2 g/kg i.v. for 1 or 2 doses in first 72 h

Penicillin Hypersensitive (Not Immediate): cephalothin 50 mg/kg to 2 g i.v. 6 hourly, cephalozin 50 mg/kg to 2 g i.v. 8 hourly

Campylobacter intestinalis: erythromycin

TETANUS (LOCKJAW): 2 notified cases in Australia in 1999; incidence 0.04/100,000 in USA; case-fatality rate 0.5 or higher in general tetanus and 0.01 in local form; neonatal tetanus (tetanus neonatorum, tetanus of the newborn), contracted through contamination of umbilical cord or stump, kills at least 800,000 worldwide each year; transmission by contamination of wound (most frequently, puncture wound; on rare occasions, surgical wound, usually due to faulty sterilisation; 10-20% of cases no wound implicated; 5-10% minor wound or only chronic skin lesions); incubation period few days to several weeks

Agent: *Clostridium tetani* (exotoxin)

Diagnosis: general: spasms of voluntary muscles and episodes of respiratory arrest; local: spasms and muscular rigidity near site of wound (may progress to general); neonatal: usually towards end of first week of life, dysphagia, spasms of facial and neck muscles leading to generalised convulsions and rigidity and death from spasms of respiratory muscles; Gram stain and culture of pus or tissue scrapings; although presence of *Clostridium tetani* is not significant in a fully immunised individual, other *Clostridium* species of very similar morphology may be found in wounds, and diagnosis of tetanus will probably be obvious clinically before it is made in the laboratory, the presence of Gram positive bacilli with typical drumstick morphology of *Clostridium tetani* in primary Gram stain or on culture should be reported immediately to the attending clinician

Treatment: 500-1000 U human tetanus immunoglobulin i.m. or 10,000 U anti-tetanus serum i.v. (? intrathecal tetanus immunoglobulin) + benzylpenicillin 10 MU (child: 50,000-250,000 U/kg) daily i.v. in 4 divided doses for 4 d or cephalosporin or erythromycin (? + prednisolone 40 mg/d orally for 10 d); pyridoxine 100 mg/d; wound debridement

Prophylaxis: highly effective vaccine (3 s.c. injections tetanus-diphtheria toxoid in infancy, with booster doses every 10 y); toxoid in wounded patients + tetanus immunoglobulin if immunisation history uncertain or 0-1 doses (also 2 doses if wound > 24 h old)

WOUND MYIASIS (TRAUMATIC MYIASIS): infestation of wounds by larvae of certain flies

Agents: *Chrysomya megacephala*, *Cochliomyia hominivorax*, *Lucilia sericata*, *Musca domestica*, *Lucilia cuprina*, *Lucilia sericata*, *Phormia regina*, *Sarcophaga albiceps*, *Sarcophaga bullata*, *Sarcophaga carnaria*, *Peckia chrysostoma*, *Sarcophaga crassipalpis*, *Gasterophilus haemorrhoidalis*, *Sarcophaga misera*, *Sarcophaga peregrina*, *Blaesoxipha plinthopyga*, *Sarcophaga ruficornis*, *Sarcophaga tibialis*, *Wohlfahrtia vigil*

Diagnosis: direct visualisation of larvae

Treatment: removal of larvae