

A Guide to
**Empirical Antibiotic
Therapy**

for



SIR GANGA RAM HOSPITAL
NEW DELHI

A GUIDE TO

EMPIRICAL ANTIBIOTIC THERAPY

FOR



Sir Ganga Ram Hospital

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MESSAGE

It gives me immense pleasure to see an important document like Antibiotic Policy being framed by the Consultants of our Hospital based on the scientific clinical microbiological data. I am sure that the doctors of this hospital will appreciate this unique effort put in by the Hospital Infection Control Committee and the Sub-Committee Members. To the best of my knowledge, this is the first document of its kind being framed in this country. I am sure we will be benefited by it. We all know that we have reached a dead end as far as antibiotics are concerned. It is only the judicious use of antibiotics by us as a community that can save humanity from the scourge of multidrug-resistant infections. Otherwise, over a period of time, it may not be of any use to have antibiotics for human use.

Dr S.K. Sama
Chairman
Board of Management
Honorary Physician to the President of India

FOREWORD

The problem of resistant strains of organisms is not new to the hospital environment. With the availability of a wide spectrum of antimicrobial agents including broad spectrum antibiotics, the medical fraternity depended more on prophylactic antimicrobial therapy than observing strict aseptic and antiseptic precautions. This resulted in the emergence of drug resistance among initially sensitive organisms.

The primary cause of hospital acquired infections (HAIs) is cross-infection, i.e. infection from person to person (from patient to patient), patient to healthcare worker and healthcare worker to patient. All steps should be taken to control HAIs by changing the work culture and attitude of healthcare workers, scrupulous observation of aseptic precautions and application of antiseptic techniques.

Further, the reduction in the incidence of HAI will be economically beneficial to both patient and hospital; reducing the length of stay of the patient, thereby releasing more beds for other patients.

The guidelines for antibiotic use at Sir Ganga Ram Hospital have been drawn up with the sole aim of preventing the emergence of drug-resistant organisms, based on the disease pattern of prevalent organisms and their antimicrobial sensitivity. These guidelines are by no means an end but shall be reviewed from time to time.

I would like to record my sincere gratitude to the members of the Sub-Committees involved in framing this document without whose intense interaction it would not have been possible to produce the guidelines in the present form.

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Dr Naini Kaul
Medical Superintendent

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A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE

A.1. COMMUNITY-ACQUIRED

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
A.1.1 COPD, Pneumonia: Betalactam (Amoxicillin) with Betalactamase inhibitor with or without Levofloxacin/Macrolide (Roxithromycin)						
(i) Betalactam + Betalactamase inhibitor						
● Augmentin (Amoxicillin + Clavulanic acid)	Tabs 375/625/ 1000 mg Syrup 200 mg/5 ml Inj. 300/600 mg	375/625/1000 mg x b.d./t.d.s.; 1–2 g/600 mg/ 300 mg i.v. x 6–8 hourly <i>Children up to 3 months:</i> 30 mg/kg/day x 12 hourly	Jaundice	Pregnancy, hepatic dysfunction, renal impairment, lymphatic leukaemia, infectious mononucleosis	Anticoagulants, allopurinol, alcohol, oral contraceptives	Hypersensitivity reactions, GI upsets. Rare, more in men >60 years on >2 weeks' treatment—cholestatic hepatitis (resolves in 1–2 weeks), blood dyscrasias, toxic epidermal necrolysis
● Ampicillin+ Sulbactam	Inj. 750 mg/1500 mg Tab 375 mg	1.5–3.0 g x i.v./i.m. (deep) x 6 hourly then 2 more doses i.v./i.m. (max 12 g/day) <i>Children:</i> 150 mg/kg/day x 12 hourly	Sensitivity to beta-lactam antibiotics	Infectious mononucleosis, renal impairment, lymphatic leukaemia, history of allergy	Allopurinol, urinary glucose determinants	GI upsets, hepatic/haematological disturbances, pseudomembranous colitis, pain at the site of injection
(ii) Levofloxacin: (alpha isomer of ofloxacin)	Tab 500 mg	500 mg x o.d./b.d.	Epilepsy, lactation, pregnancy, avoid in children	Renal impairment, G6PD deficiency, severe persistent diarrhoea (discontinue), porphyria, avoid strong ultraviolet light	Iron salts, antacids, cimetidine, sucralfate, NSAIDs, fenbufen, probenecid	GI upsets, increase in liver enzymes, tendon disorders (discontinue)
(iii) Macrolide						
● Roxithromycin	Tabs 150/300 mg; Dispersible tabs 50 mg Kid tabs 50 mg Syrup 50 mg/5 ml	150–300 mg x b.d.	Concurrent administration of ergotamine	Hepatic insufficiency, pregnancy, lactation		Nausea, vomiting, gastritis, diarrhoea. Rare: rashes, transient increase in liver transaminases

For duration refer page 38

Use antibiotics judiciously

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
● Erythromycin	Tabs 250/500 mg Dispersible tabs 125 mg Drops 100 mg/ml Syrup 125 mg/5 ml	250/500 mg x b.d./t.d.s. x 5–7 days <i>Children 3–8 years:</i> 100/200 mg initially then 100 mg x t.d.s x 5–7 days <i>Small children:</i> 10–20 drops x 3–4 times/day	Impaired renal function, history of jaundice	Renal impairment, increased QT interval, porphyria, symptoms of cholestatic jaundice (stop immediately)	Theophylline, digoxin, carbamazepine, oral anticoagulants, astemizole, terfenadine (avoid), cisapride, cimetidine, ergotamine	Nausea, vomiting, diarrhoea, abdominal discomfort, urticaria. Reversible hearing loss (on high doses). Cholestatic jaundice if given for more than 14 days, pseudomembranous colitis
● Azithromycin	Tabs 250/500 mg Dry syrup 100/200 mg/5 ml	500 mg x o.d. x 3 days 1 hour before food	Hepatic impairment	Renal/hepatic disorders, pregnancy, lactation, elderly, prolonged QT interval, porphyria	Ergot derivatives, antacids, cyclosporine, digoxin, warfarin, terfenadine, astemizole	GI upsets, reversible elevation of liver enzymes, allergic reactions, rash, angioneurotic oedema, anaphylaxis, pseudomembranous colitis, vaginitis, cholestatic jaundice, reversible hearing loss on prolonged therapy
● Clarithromycin	Tabs 250/500 mg	250 mg x b.d. x 7 days; if severe infection 500 mg x b.d. x 14 days	Hypersensitivity to macrolides, history of jaundice	Cholestatic hepatitis, reversible abnormal liver function on prolonged or repeated therapy, pregnancy, lactation	Theophylline, digoxin, oral anticoagulants, carbamazepine	GI disturbances, allergic reactions

For duration refer page 38

Think before you prescribe antibiotics

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
A.1.2 Urinary tract infections: Nitrofurantoin/Nalidixic acid. Confirm evidence of pyelonephritis and treat accordingly						
(i) Nitrofurantoin	Tabs 50/100 mg	50/100 mg x b.d./t.d.s. Lower urinary tract infection (cystitis) may need treatment for 3 days only	Severe oliguria, anuria, impaired renal function, infants <1 month	Can acidify urine, may cause hepatic damage	Magnesium trisilicate, probenecid and quinolones	Withdraw if symptoms of pulmonary reaction, e.g. chronic desquamative interstitial pneumonia with fibrosis, intrahepatic cholestasis, hepatitis similar to chronic active hepatitis, haemolysis, peripheral neuropathy. May cause haemolytic anaemia in G6PD deficiency. Hypersensitivity reactions, GI upsets, blood dyscrasias
(ii) Nalidixic acid	Tabs 500 mg Kid tabs 125 mg	500/125 mg Lower urinary tract infections (cystitis) may need treatment for 3 days only	History of convulsive disorders	Avoid strong sunlight, in epilepsy, lactation, liver/kidney dysfunction, cerebral arteriosclerosis, elderly, children, G6PD deficiency	Anticoagulants, antibacterials, probenecid, caffeine, antacids, nitrofurantoin	Weakness, GI, CNS or visual disturbances, skin rashes, blood dyscrasias, convulsions, photosensitivity, cholestasis, toxic psychoses, paraesthesia
A.1.3 Skin and soft tissue/bone/joint: Cloxacillin/Clindamycin/Cephalexin—Necrotizing fasciitis: High-dose Penicillin + Clindamycin						
(i) Penicillinase-resistant Penicillins Cloxacillin	Caps 250/500 mg Inj. 250/500 mg Syrup 125 mg/5 ml	250/500 mg x b.d./t.d.s. 1–4 g/day in divided doses <i>Children:</i> <1 year: 62.5 mg/kg/day 1–5 years: 62.5 mg/kg/day 6–12 years: 125–200 mg/kg/day	Hypersensitivity to penicillins, asthma, hay fever or urticaria			GI disturbances

For duration refer page 38–39

Start antibiotics after microbiology work-up

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(ii) Lincosamide group Clindamycin	Caps 150/300 mg Inj. 150/300 mg	150–900 mg x 8 hourly or 150–450 mg x 6 hourly i.v./i.m.	Diarrhoeal states	Discontinue if persistent diarrhoea or colitis, renal/hepatic impairment, monitor liver function and blood counts if prolonged treatment, pregnancy	Neuromuscular blocking agents	GI disturbances including pseudomembranous colitis, jaundice, altered liver function tests, rashes, neutropenia and eosinophilia
(iii) First-generation oral Cephalosporins ● Cephalexin	Caps 250/500 mg Tabs 250/500 mg Syrup 125 mg/5 ml	250/500 mg x b.d./t.d.s. (1–4 g/day) Children: 25/50 mg/kg x q.i.d.	Known hypersensitivity to cephalosporins	Hypersensitivity to penicillins, renal dysfunction, history of allergy, lactation	Loop diuretics and nephrotoxic drugs	GI disturbances, superinfection, pseudomembranous colitis (rare)
● Cefadroxil	Tabs 500 mg/1 g Syrup 125 mg/5 ml Dispersible tabs 250 mg	500 mg–1 g x o.d./b.d. Children: 30 mg/kg/day x b.d.	Known hypersensitivity to cephalosporins	Hypersensitivity to penicillins, renal impairment, pregnancy, lactation		GI disturbances, headaches, rash/pruritus, pseudomembranous colitis, urticaria
● Cephazolin	Inj. 500 mg/1 g	500 mg–1 g x i.m./i.v. Children: 25/50 mg/kg/day x 3–4 doses	Neonates below 1 month of age	Hypersensitivity, renal dysfunction, pregnancy	Loop diuretics, probenecid, aminoglycosides	Pain at site of injection, hypersensitivity reactions, GI upsets, candidiasis, convulsions, eosinophilia, neutropenia, leucopenia, phlebitis, increased liver enzymes, positive Coombs' test

For duration refer page 39

Use antibiotics only if you must

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(iv) High-dose penicillin: (natural penicillins group) Penicillin G	Inj. 400 000/ 600 000 U/vial Paediatric: 200 000/ 300 000 U/vial Forte: 800 000 U/vial	Low-dose: 600 000 U–1.2 million units High-dose: >20 million units o.d. i.v.	Hypersensitivity to penicillins	History of allergy, renal impairment		GI disturbances, anaphylactic reactions in 0.05% of which 5%–10% are fatal, angioedema. With procaine penicillin G/ benzathine penicillin: transient but toxic reaction with bizarre behaviour and neurological reactions (Hoignes syndrome)
(v) Clindamycin [A.1.3(ii)]						
A.1.4 Intra-abdominal and hepatobiliary: Oral Quinolones with Clindamycin/with or without Metronidazole						
(i) Oral quinolones ● Ciprofloxacin	Tabs 250/500 mg Inj. 200 mg for i.v. infusion	250/500/750 mg x b.d./t.d.s. (also available as i.v. infusion 100–400 mg over 30–60 min x b.d.) <i>Children:</i> not recommended, but if given 7.15–15 mg/kg/day	Growing children <12 years, pregnancy, lactation, hypersensitivity to ciprofloxacin	History of convulsive disorders, severe renal impairment, CNS disorders, G6PD deficiency	Theophylline, cyclosporine, alcohol, antacids, anticoagulants, caffeine, probenecid, NSAIDs	GI disturbances, dizziness, headache, tremors, confusion, convulsions, rashes. Blurred vision, toxic psychosis, impairment of judgement and dexterity. Haematological, hepatic and renal disturbances, crystalluria, Steven–Johnson syndrome. Tachycardia, transient hearing loss, tenosynovitis (occasional quinolone-induced cartilage toxicity in children), impaired taste/smell

For duration refer page 38

Prevent drug abuse; use antibiotics prudently

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
● Ofloxacin	Tabs 200/400 mg, i.v. infusion 200/400 mg	200–400 mg x b.d., i.v. infusion: 200–800 mg over 30 min	Hypersensitivity to any fluoroquinolones, children <16 years, pregnancy, lactation, and history of epilepsy	Exposure to sunlight/UV rays, psychiatric disorders, renal impairment	Magnesium or aluminium antacids, iron	GI upsets, hypersensitivity reactions, skin reactions, CNS disturbances—seizures in the elderly, pseudomembranous colitis, transient increase in hepatic enzymes, rarely joint/muscle pain, bone marrow depression
(ii) Clindamycin [A.1.3(ii)]						
(iii) Metro-nidazole (Metrogyl)	Tabs 200/400 mg Suspension 200 mg/5 ml i.v. infusion 500 mg/100 ml	200–400 mg x t.d.s. <i>Children:</i> 7.5 mg/kg x t.d.s.	Blood dyscrasias, active CNS disease, first trimester of pregnancy, lactation	Reduce dose of antihypertensive drug being given, pregnancy	Alcohol (avoid), oral anticoagulants, phenobarbitone, cimetidine, phenytoin, disulfiram	GI distress, furred tongue, unpleasant taste, leucopenia, urticaria, angioedema, CNS disturbances, dark coloured urine, neuropathy, epileptiform seizures on long-term treatment
<b style="color: red;">A.1.5 CNS: Ceftriaxone or refer to the guidelines given under Medical Specialties (p. 25)						
(i) Third-generation Cephalosporins ● Ceftriaxone	Inj. 250 mg/1 g	Meningitis 4 g x i.v. initially then 2 g x i.v. x o.d. <i>Children:</i> 50–75 mg/kg/day	Hypersensitivity	Renal/hepatic dysfunction, in neonates, pregnancy, lactation, impaired vitamin K synthesis, superinfection—may cause colitis		Superinfection, diarrhoea, pseudomembranous colitis, local reaction, hypoproteinaemia

For duration refer pages 38–39

Use antibiotics judiciously

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.1. COMMUNITY-ACQUIRED (CONTD.)

<i>Drug</i>	<i>Available as</i>	<i>Dose</i>	<i>Contraindications</i>	<i>Special precautions</i>	<i>Drug interaction</i>	<i>Side-effects</i>
● Cefoperazone	Inj. 1 g	<i>Adults and children >12 years:</i> 1–2 g x i.m. or i.v. x 12 hourly (maximum 8 g/day x 3–4 divided doses) <i>Children:</i> 50–200 mg/kg/day x 2 divided doses	Hypersensitivity to cephalosporins or penicillin, haemorrhagic tendency	Monitor blood clotting (vit K to be given s.o.s). Hepatic/renal dysfunction, pregnancy, lactation	Alcohol	Pain at the site of injection, GI disturbances, urticarial rashes, fever, neutropenia
● Cefotaxime	Inj. 125/250/500 mg/1 g	1–2 g x deep i.m./slow i.v./i.v. infusion x 12 hourly (maximum 12 g/day). <i>Neonates:</i> 100/150 mg/kg/day in 2–3 divided doses <i>Infants/children:</i> 50–180 mg/kg/day x 4–6 divided doses (maximum 180 mg/kg)	Loop diuretics, aminoglycosides	Renal impairment, hypersensitivity to penicillin		Pain at the site of injection, hypersensitivity reactions, GI disturbances, candidiasis, eosinophilia, neutropenia, leucopenia, thrombocytopenia, increased liver enzymes/blood urea, positive Coombs' test

For duration refer page 38–39

Think before you prescribe antibiotics

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.2 HOSPITAL-ACQUIRED

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
A.2.1 CNS: Third-generation Cephalosporins [A.1.5(i)]						
A.2.2 Intra-abdominal and hepatobiliary: Netilmicin + Ofloxacin with or without Metronidazole						
(i) Aminoglycosides ● Netilmicin	Inj. 10, 25, 50, 100, 200 mg	<i>UTI/non life-threatening:</i> 4–6 mg/kg x o.d. or in 2–3 divided doses <i>Life-threatening infections</i> up to 7.5 mg/kg/day x 3 divided doses. All by i.m. or slow i.v. injection <i>Children <1 week</i> 3 mg/kg x 12 hourly; <i>1 week–2 years</i> 2.5–3 mg/kg x 8 hourly; <i>>2 years</i> 2–2.5 mg/kg x 8 hourly. All by slow i.v./i.m.	Pregnancy, lactation	Myasthenia gravis, parkinsonism control blood levels and total dose in renal impairment. Dehydration, monitor serum levels, prolonged use and high dose—sensitivity, accumulation, elderly, infant botulism, hypocalcaemia	Neuromuscular blocking drugs, anaesthetics, ethacrynic acid, frusemide, cephalosporins, citrated blood	Oto/nephro/neurotoxicity, tachycardia, palpitations, hypotension, paraesthesia, chills, fluid retention, GI upsets, malaise, visual disturbances, headache, superinfection
● Amikacin	Inj. 100/250/500 mg/2 ml	15 mg/kg x 2 divided doses up to 10 days (maximum 15 g) <i>Children:</i> initially 10 mg/day then 7.5 mg/day x 2 divided doses	Pregnancy	Renal impairment, ensure adequate hydration	Frusemide, ethacrynic acid, anaesthetics, neuromuscular blocking drugs	Oto/nephrotoxicity

For duration refer pages 38–39

Start antibiotics after microbiology work-up

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE (CONTD.)

A.2 HOSPITAL-ACQUIRED (CONTD.)						
Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
● Gentamicin	Inj. 20/40/80 mg/ 2 ml Paediatric inj. 10 mg/ ml	2 mg/kg loading dose then 3–5 mg/kg/day x divided doses x 7–10 days	Pregnancy, myasthenia gravis	Renal impairment, infants, elderly. Avoid prolonged use, monitor serum levels as >10 mcg/ml leads to auditory/vestibular toxicity, parkinsonism	Neuromuscular blocking agents, anaesthetics, frusemide, ethacrynic acid	Auditory and vestibular damage, renal toxicity. Rarely hypomagnesaemia on prolonged treatment, pseudomembranous colitis
(ii) Ofloxacin [A.1.4(i)]						
(iii) Metronidazole [A.1.4(iii)]						
A.2.3 Skin and soft tissue/bone/joint: Clindamycin/Cephalexin—Necrotizing fasciitis: High-dose Penicillin + Clindamycin						
(i) Clindamycin [A.1.3 (ii)]						
(ii) Cephalexin [A.1.3 (iii)]						
(iii) High-dose penicillin [A.1.3 (iv)] + Clindamycin [A.1.3 (ii)]						
A.2.4 Urinary tract infection: Netilmicin + Ofloxacin						
(i) Netilmicin [A.2.2 (i)] + Ofloxacin [A.1.4 (i)]						
A.2.5 COPD, Pneumonia: Fluoroquinolone (Levofloxacin)/Aminoglycoside (Amikacin) + Cefpirom, with or without Clindamycin						
(i) Levofloxacin [A.1.1 (ii)]						
(ii) Amikacin [A.2.2 (i)]						
(iii) Cefpirom	i.v. 1–2 g	1–2 g x 12 hourly	Hypersensitivity	Hepatic/renal dysfunction, pregnancy, lactation, monitor blood clotting		Pain at site of injection, hypersensitivity reactions, rashes, fever, neutropenia
(iv) Clindamycin [A.1.3(ii)]						

For duration refer page 38–39

Use antibiotics only if you must

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES

B.1 RESPIRATORY DISORDERS

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES

B.1 RESPIRATORY DISORDERS

B.1.1 Community-acquired pneumonitis: Betalactam + Betalactamase inhibitor with or without Macrolide

(i) Betalactam + Betalactamase inhibitor

- Augmentin [A.1.1(i)]

(ii) Macrolide [A.1.1(iii)]

B.1.2 Severe pneumonitis: Betalactam with Betalactamase inhibitor + Aminoglycoside with or without Clindamycin

(i) Betalactam + Betalactamase inhibitor [A.1.1 (i)] + Aminoglycoside [A.2.2 (i)]

(ii) Clindamycin [A.1.3(ii)]

B.1.3 Ventilator-associated pneumonitis (VAP): ● Acquired before 5 days: Cefpirom + Aminoglycoside (Amikacin) with or without Levofloxacin (see also Annex V) ● Acquired after 5 days: Fluroquinolone (Levofloxacin)/Piperacillin + Tazobactam with or without Clindamycin

(i) Cefpirom [A.2.5(iii)] + Aminoglycoside (Amikacin) [A.2.2(i)]

(ii) Fluroquinolones (Levofloxacin) [A.1.1(ii)]

For duration refer page 38

Prevent drug abuse; use antibiotics prudently

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES (CONTD.)

B.1 RESPIRATORY DISORDERS (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(iv) Piperacillin + Tazobactam (Zosyn)	Inj. 4 g + 0.5 g	4.5 g slow i.v. infusion x 8 hourly <i>Neutropenic adults:</i> 4.5 g x slow i.v./infusion x 6 hourly with aminoglycoside <i>Children: (neutropenic <50 kg)</i> 90 mg/kg x slow i.v./infusion x 6 hourly with aminoglycoside <i>>50 kg:</i> same as adults <i><2 years:</i> 112.5 mg/kg x slow i.v. infusion x 8 hourly (maximum 4.5 g x 8 hourly)		Bleeding manifestations, monitor haemopoietic functions, pregnancy, lactation, neonates, children 9–12 years	Aminoglycosides, anti-coagulants, probenecid, non-depolarizing muscle relaxants, methotrexate	Superinfection, GI upsets, allergic reactions, phlebitis, oedema, bleeding manifestations. Rare: leucopenia, renal failure, haemolytic anaemia, cholestatic jaundice, pseudomembranous colitis (discontinue)
(v) Clindamycin [A.1.3(ii)]						
B.2. GASTROINTESTINAL DISORDERS						
B.2.1 Cholangitis: Netilmicin + Ofloxacin						
(i) Netilmicin [A.2.2(i)] + Ofloxacin (Fluoroquinolone) [A.1.4(i)]						
B.2.2 Severe sepsis: Tazobactam + Piperacillin						
(i) Tazobactam + Piperacillin [B.1.3(iv)]						
B.3. RENAL SEPTICAEMIA/SEPSIS						
B.3.1 Acute pyelonephritis (demonstrate pyuria): Ofloxacin + Netilmicin						
(i) Ofloxacin [A.1.4(i)] + Netilmicin [A.2.2(i)]						

For duration refer page 38

Use antibiotics judiciously

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES (CONTD.)

B.3 RENAL SEPTICAEMIA/SEPSIS (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
B.3.2 Haemodialysis/vascular access-related sepsis: Cloxacillin/Clindamycin. In case of high chance of MRSA: Teicoplanin/Vancomycin						
(i) Cloxacillin [A.1.3(i)]						
(ii) Clindamycin [A.1.3(ii)]						
(iii) Teicoplanin	Inj. 400/200 mg	<i>Moderate inf.:</i> 400 mg i.v./i.m. x o.d. first day, then 200 mg i.v./i.m. x o.d.; <i>Severe inf:</i> 400 mg i.v. x 12 hourly x 3 doses, then 400 mg i.v./i.m./day, decrease dose from fourth day in renal insufficiency; <i>Neonates:</i> 16 mg/kg x single i.v. infusion over 30 min x first day, then 8 mg/kg x single dose. <i>Children >2 months:</i> 10 mg/kg i.v./i.m. x 12 hourly x 3 doses, then 6 mg/kg i.v./i.m. x single dose x o.d. For MRSA x 3–4 weeks		Hypersensitivity to vancomycin, on prolonged use monitor hepatic/renal, haematological and auditory tests. Pregnancy, lactation, elderly, renal impairment, superinfection	Aminoglycosides, cephaloridine, colistin	Local reaction at site of injection, thrombophlebitis, rash, fever, rigor, bronchospasm, anaphylaxis. GI upsets, angioedema, exfoliative dermatitis, erythema multiforme. Dizziness, mild hearing loss, vestibular disorders, tinnitus, headache. Blood dyscrasias, increase in serum transaminases/ alkaline phosphatase/creatinine, renal failure, superinfection

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES (CONTD.)

B.3 RENAL SEPTICAEMIA/SEPSIS (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(iv) Vancomycin	Inj. 500 mg Cap 125 mg	500 mg x 6 hourly or 1 g x 2 hourly slow i.v. infusion over 60 min. <i>Children:</i> 10 mg/kg x 6 hourly by slow i.v. over 60 min or 20 mg/kg/day x 3-4 divided doses x 7-10 days (maximum 2 g/day) MRSA x 3-4 weeks		Impaired renal function, previous hearing loss, elderly, pregnancy. Monitor blood levels, renal and auditory functions	Neurotoxic/nephrotoxic drugs, anaesthetics	Infusion-related events (anaphylactoid reactions), flushing, nephrotoxicity, ototoxicity, neutropenia, nausea, chills, fever, rashes, eosinophilia, phlebitis

B.3.3 Septicaemia: Tazobactam + Piperacillin with or without Clindamycin

(i) Tazobactam + Piperacillin [B.1.3(iv)] / (ii) Clindamycin [A.1.3(ii)]

B.4. CENTRAL NERVOUS SYSTEM

B.4.1 Community-acquired bacterial meningitis in immunocompetent cases: Crystalline Penicillin (via a central line and diluted in physiological solution)

(i) Crystalline penicillin (Sodium penicillin) [A.1.3(iv)]

B.4.2 Elderly age group and immunocompromised with bacterial meningitis: Cefotaxime/Ceftriaxone

(i) Cefotaxime [A.1.5(i)] / (ii) Ceftriaxone [A.1.5(i)]

B.4.3 Shunt-associated: Cloxacillin (in case of strong clinical evidence of MRSA Teicoplanin/Vancomycin + Amikacin)

(i) Cloxacillin [A.1.3(i)] / (ii) Teicoplanin [B.3.2(iii)] / (iii) Vancomycin [B.3.2(iv)] / (iv) Amikacin [A.2.2(i)]

B.4.4 Complicated meningitis: Aminoglycoside (Netilmicin) + Third-generation Cephalosporins (Ceftriaxone)

(i) Aminoglycoside (Netilmicin) [A.2.2(i)] + Third-generation Cephalosporins (Ceftriaxone) [A.1.5(i)]

For duration refer page 38-39

Start antibiotics after microbiology work-up

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES (CONTD.) / C. THE ICU**B.4 CENTRAL NERVOUS SYSTEM (CONTD.)**

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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B.4.5 Brain abscess: Tazobactam + Piperacillin/Cefpirom with or without Metrogl

(i) Tazobactam + Piperacillin [B.1.3(iv)] / (ii) Cefpirom [A.2.5(iii)] / (iii) Metrogl (Metronidazole) [A.1.4(iii)]

C. EMPIRICAL ANTIBIOTIC THERAPY FOR THE ICU**C.1. CLEAN CASES**

Group 1: Clean cases admitted from outside directly to the ICU with no evidence of sepsis:

(i) No antibiotics to be administered

Group 2: Patients admitted to the ICU from outside on antibiotics with evidence of sepsis (clinical or otherwise). Change antibiotics after collecting samples for microbiological work-up.

(i) Augmentin [A.1.1(i)] + Amikacin [A.2.2.(i)] for 48 hours. Review in light of investigations

Group 3: Patients admitted to the ICU on antibiotics with documented evidence of infection and showing improvement

(i) The same antibiotics to be continued unless proved otherwise.

Group 4: Patients transferred from the OT to the ICU

(i) The surgical antibiotic policy (p. 27) should be continued in the ICU unless there is evidence and a change or withdrawal of antibiotics is required.

Group 5: Patients transferred from a floor of the hospital to the ICU

(i) Antibiotics as per the antibiotic policy for general medicine/medical specialties to continue.

C.2. CASES WITH EVIDENCE OF SEPSIS NEEDING ICU ADMISSION/ALREADY IN THE ICU**C.2.1 Community-acquired infections: the general medicine/medical specialties antibiotic policy shall be applicable****C.2.2 Community-acquired pneumonia: Levofloxacin**

(i) Levofloxacin [A.1.1(iii)]

For duration refer page 38

Use antibiotics only if you must

C. EMPIRICAL ANTIBIOTIC THERAPY FOR THE ICU (CONTD.) / D. SURGERY

C.2 CLEAN CASES WITH EVIDENCE OF SEPSIS (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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C.2.3 ● Nosocomial infections such as pneumonia, phlebitis, UTI (after sending cultures) (see also Annex V, page 37). Clindamycin + Amikacin + Ofloxacin

(i) Clindamycin [A.1.3(ii)] + Amikacin [A.2.2(i)] + Ofloxacin [A.1.4(i)]

- Ventilator-associated pneumonia to be treated as above or Zosyn + Amikacin

(i) Zosyn [B.1.3(iv)] + Amikacin [A.2.2(i)]

C.2.4 Severe phlebitis or device-associated septicaemia Teicoplanin / Vancomycin + Amikacin

(i) Teicoplanin [B.3.2(iii)] or

(ii) Vancomycin [B.3.2(iv)] + Amikacin [A.2.2(i)]

D. EMPIRICAL ANTIBIOTIC THERAPY FOR SURGERY

D.1 CLEAN CASES: ONLY ONE DOSE AT INDUCTION, REPEAT SECOND DOSE IF SURGERY LONGER THAN 4 HOURS

— Choice I

(i) Betalactam + Aminoglycosides [A.2.2(i)]

● Amoxicillin	Caps 250/500 mg Syrup 125 mg/5 ml Also available as i.m./i.v. injection	500 mg i.m. or i.v. stat		Infectious mononucleosis, renal impairment, lymphatic leukaemia, history of allergy	Allopurinol, urine glucose determinants	Hypersensitivity, GI upsets, hepatic/ haematological disturbances, pseudomembranous colitis
● Ampicillin	Caps 250/500 mg Syrup 125/5 ml Also available as i.m./i.v. injection	500 mg i.m. or i.v. stat		Infectious mononucleosis, renal impairment, lymphatic leukaemia, hypersensitivity	Allopurinol, urine glucose determinants	Hypersensitivity, GI upsets, hepatic/ haematological disturbances, pseudomembranous colitis

— Choice II

(i) First-generation Cephalosporins, Cefazolin [A.1.3(iii)]

For duration refer page 38–39

Prevent drug abuse; use antibiotics prudently

D. EMPIRICAL ANTIBIOTIC THERAPY FOR SURGERY (CONTD.)

D.1 CLEAN CASES (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(ii) Second-generation Cephalosporins ● Cefuroxime	Inj. 1.5 g Inj. 500 mg/1 g	1.5 g i.v. stat 500 mg–1 g i.m./i.v. x 6–8 hourly <i>Children:</i> 38 mg/kg/day x b.d.	Known hyper-sensitivity to cephalosporins	Hypersensitivity to penicillins, renal impairment, pregnancy, lactation	Loop diuretics, probenecid, aminoglycosides	Pain at the site of injection, GI upsets, candidiasis, convulsions, eosinophilia, neutropenia, leucopenia, phlebitis, increased liver enzymes, positive Coombs' test

— **Choice III**

(i) Consultant's own choice with justification

D.2 CLEAN CONTAMINATED CASES

D.2.1 Road traffic accidents: Assess the extent and site of injury

— **Choice I**

(i) First-generation Cephalosporins [A.1.3(iii)]

— **Choice II**

(i) Betalactam + Betalactamase inhibitor (Augmentin/Ampicillin + Sulbactam) [A.1.1(i)]

(ii) with or without Metronidazole [A.1.4(iii)]

D.2.2 Biliary and GI surgery

— **Choice I:** For routine surgery

(i) Second-generation Cephalosporins (Cefuroxime) [D.1(Choice II)]/with or without Clindamycin [A.1.3(ii)]

For duration refer page 38

Use antibiotics judiciously

D. EMPIRICAL ANTIBIOTIC THERAPY FOR SURGERY (CONTD.)

D.2 CLEAN CONTAMINATED CASES (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
— Choice II						
(i) Zosyn [B.1.3(iv)]/(ii) Magnex (iii) with or without Metronidazole [A.1.4(iii)]						
(ii) Magnex (Cefoperazone + Sulbactam 1:1)	Available as Inj. 1 g/2 g i.v./i.m.	2–4 g stat	Patients with known allergy to penicillin or cephalosporins		Aminoglycosides, do not infuse in the same i.v. line	Diarrhoea, rash, fever, nausea, vomiting

D.2.3 Genitourinary system

(i) Quinolones (Ofloxacin) [A.1.4(i)] + Aminoglycosides (Gentamicin) [A.2.2(i)]

D.3 CONTAMINATED/SEPTICAEMIA CASES: BETALACTAM + BETALACTAMASE INHIBITOR WITH OR WITHOUT METRONIDAZOLE

D.3.1 Soft tissue infections – cover *Staph. aureus*

D.3.2 GI infections – cover *E. coli* and anaerobes

D.3.3 GU infections – cover *E. coli* and *Pseudomonas*

Note: All efforts should be made to establish bacterial infection from pus, blood, body fluids, etc.

D.4 SURGICAL CASES INVOLVING SURGICAL IMPLANTS

— Choice I

(i) Clindamycin [A.1.3(ii)] + Ofloxacin [A.1.4(i)]

— Choice II (Note: Two doses recommended; first at induction of anaesthesia, the second 4 hours after surgery)

(i) Teicoplanin [B.3.2(iii)] or Vancomycin [B.3.2(iv)] + Ofloxacin [A.1.4(i)]

For duration refer page 38

Think before you prescribe antibiotics

E. EMPIRICAL ANTIBIOTIC THERAPY FOR TRANSPLANT SURGERY

E.1 RENAL TRANSPLANT

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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E.1.1 Recipient presumed a clean case. First-line therapy

(i) Second-generation Cephalosporins

- Inj. Cefuroxime [D.1 (Choice II)] (only 2 doses recommended: first dose half an hour before surgery and the second 4 hours after surgery)

E.1.2 Donor: as above

E.1.3 Graft nephrectomy

(i) Inj. Ofloxacin [A.1.4(i)] + Inj. Gentamicin [A.2.2(i)] (only 2 doses recommended: first dose half an hour before surgery and the second 4 hours after surgery)

E.1.4 Native nephrectomy: the definitive therapy is known, therefore a policy is not required.

E.1.5 CAPD

(i) Clindamycin [A.1.3(ii)] + Gentamicin [A.2.2(i)]

In case of strong suspicion of MRSA, use (i) Teicoplanin [B.3.2(iii)] / Vancomycin [B.3.2(iv)]

E.2 LIVER TRANSPLANT: ELECTIVE TREATMENT

(i) Zosyn [B.1.3(iv)] + Teicoplanin [B.3.2(iii)]

Note: 2 doses are recommended. Continue other antibiotics such as:

(ii) Fluconazole	Caps 50/150/200 mg Infusion: 2 mg/ml	<p><i>Mucosal:</i> 50–100 mg/day x 14–30 days</p> <p><i>Systemic:</i> 400 mg initially then 200–400 mg x o.d.</p> <p><i>Prophylaxis for fungal infections:</i> 50–100 mg x o.d. i.v. infusion: 50–100 mg @ 5–10 ml/min</p> <p><i>Children >1 year</i> 3–6 mg/kg/day</p>	Pregnancy, lactation	Renal impairment in multiple-dose therapy	Anticoagulants, rifampicin, theophylline, warfarin, phenytoin, cyclosporine	GI upsets, rashes
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For duration refer page 38

Start antibiotics after microbiology work-up

E. EMPIRICAL ANTIBIOTIC THERAPY FOR TRANSPLANT SURGERY (CONTD.)

E.2 LIVER TRANSPLANT (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
(iii) INH	Liquid 100 mg/5 ml Tabs 100/300 mg	300 mg/day in 1–3 divided doses; <i>Children:</i> 10–20 mg/kg/day in 1–3 divided doses (maximum 300–500 mg/day)	Drug-induced hepatitis	Epilepsy, renal impairment, chronic alcoholism, convulsive disorders		Hepatic disorders, dose-dependent peripheral neuropathy, rare—optic nerve damage or psychosis, blood dyscrasias, rheumatic syndrome, LE-like signs, mild CNS syndromes
(iv) Septran	Tabs Trimethoprim 80 mg + sulphamethoxazole 400 mg Tab forte 160 mg + 800 mg Suspension Trimethoprim 40 mg/sulphamethoxazole 200 mg/5 ml	1 tab x b.d. x 5–7 days or tab forte x b.d. x 5–7 days <i>Children: 2–5 years:</i> 1 tab x b.d.; <i>6–12 years:</i> 2 x b.d. x 5–7 days	Hypersensitivity, pregnancy, anaemia, blood dyscrasias. Malabsorption syndromes, severe renal/hepatic impairment, neonates	Lactation, if impaired renal function, reduce dose to 1/2 or 1/3 x 12 hourly. Maintain adequate urinary volume to avoid crystalluria. In the elderly, check BP regularly	Folate inhibitors, oral hypoglycaemics, anticoagulants, coumarin anticoagulants	Nausea, vomiting, skin rashes, glossitis. Blood dyscrasias, folate deficiency. Rare: erythema multiforme, Lyell syndrome

(v) Monitor CMV using NASBA assay at first indication before start of therapy for CMV

E.3. CADAVERIC AND SEMI-ELECTIVE TRANSPLANT: Both liver and renal transplant. A combination of Meropenem and Teicoplanin can be used

(i) Carbapenems ● Meropenem	0.5–1 g	0.5–1 g x 8 hourly				Seizure incidence 0.5%–1% with 0.5 g x 6 hourly and 10% with 1 g x 6 hourly
● Imipenem + Cilastatin	0.5 g	0.5 g x 6 hourly i.v.				Does not require a dehydropeptidase inhibitor (cilastatin). In the elderly with decreased renal function, cerebrovascular disease or seizure disorders, dosage needs to be decreased. Cross-reactivity in patients with anaphylaxis to penicillin.

For duration refer page 38

Use antibiotics only if you must

E. EMPIRICAL ANTIBIOTIC THERAPY FOR TRANSPLANT SURGERY / F. CVT AND CARDIAC SURGERY/ G. PAEDIATRIC SURGERY**E.3. CADAVERIC AND SEMI-SELECTIVE TRANSPLANT (CONTD.)**

<i>Drug</i>	<i>Available as</i>	<i>Dose</i>	<i>Contraindications</i>	<i>Special precautions</i>	<i>Drug interaction</i>	<i>Side-effects</i>
(ii) Teicoplanin [B.3.2(iii)]						

F. EMPIRICAL ANTIBIOTIC THERAPY FOR CVT AND CARDIAC SURGERY (2 DOSES)

(i) Inj. Ofloxacin [A.1.4(i)] + Clindamycin [A.3.(ii)] or Teicoplanin [B.3.2(iii)] (MRSA) (details on p. 25–26)

G. EMPIRICAL ANTIBIOTIC THERAPY FOR PAEDIATRIC SURGERY**G.1 DAY-CARE SURGERY****G.1.1 Clean cases (hernia, circumcision, orchidopexy)**

(i) Inj. Cefuroxime [D.1 Choice II] as a single dose before or at the time of the induction

G.2 OLDER CHILDREN (MAJOR CASES)**G.2.1 Clean, clean-contaminated cases (2 doses recommended, one at the time of induction and the second after 4–6 hours)****– Choice I**

(i) Second-generation Cephalosporins [D.1(Choice II)] + Gentamicin [A.2.2(i)]

– Choice II

(ii) Cloxacillin [A.1.3(i)] + Gentamicin [A.2.2(i)]

G.2.2 Contaminated cases**– Choice I**

(i) Third-generation Cephalosporins [A.1.5(i)] + Gentamicin [A.2.2(i)]

For duration refer page 38

Prevent drug abuse; use antibiotics prudently

G. EMPIRICAL ANTIBIOTIC THERAPY FOR PAEDIATRIC SURGERY (CONTD.)

G.2 OLDER CHILDREN (MAJOR CASES) (CONTD.)

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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– Choice II

(ii) Amikacin [A.2.2(i)] + Metronidazole [A.1.4(iii)]

G.3 NEONATAL SURGERY (2 DOSES)

G.3.1 Clean cases

(i) Second-generation Cephalosporins [D.1(Choice II)] + Gentamicin [A.2.2(i)]

G.3.2 Clean contaminated cases

(i) Third-generation Cephalosporins [A.1.5(i)] + Aminoglycosides (Gentamicin/Amikacin) [A.2.2(i)]

G.3.3 Contaminated cases

(i) Third-generation Cephalosporins [A.1.5(i)] + Aminoglycosides (Gentamicin/Amikacin) [A.2.2(i)] + Metronidazole [A.1.4(iii)]

G.4 SPECIAL SITUATIONS

G.4.1 MRSA/MRSE

(i) Vancomycin [B.3.2(iv)] or Teicoplanin [B.3.2(iii)]

G.4.2 Prophylaxis for UTI

(i) Co-trimoxazole (Septran) [E.2(v)] / Nitrofurantoin [A.1.2(i)] + (ii) Cephalexin [A.1.3(iii)] (for babies up to 3 months)

H. EMPIRICAL ANTIBIOTIC THERAPY FOR NEUROSURGERY

H.1 ROUTINE USE

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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H. EMPIRICAL ANTIBIOTIC THERAPY FOR NEUROSURGERY: NO ANTIBIOTICS FOR CLEAN CASES OTHER THAN CHEMOPROPHYLAXIS

H.1 ROUTINE USE

(i) Cloxacillin [A.1.3(i)] + Gentamicin [A.2.2(i)]

H.2 FRACTURE SKULL WITH CSF LEAK: No routine use of antibiotics. Look for evidence of infection and use evidence-based definitive therapy

H.3 NEUROSURGERY LASTING LESS THAN 4–6 HOURS: Cefuroxime before induction as chemoprophylaxis (1 dose only)

(i) Second-generation Cephalosporins (Cefuroxime) [D.1(Choice II)]

H.4 NEUROSURGERY LASTING MORE THAN 6 HOURS (2 doses, one at induction and the second after 8 hours)

(i) Second-generation Cephalosporins [D.1(Choice II)] + Amikacin [A.2.2(i)]

H.5 COMMUNITY-ACQUIRED BACTERIAL MENINGITIS IN IMMUNOCOMPETENT CASES

(i) Crystalline Penicillin [A.1.3(iv)]

H.6 ELDERLY AGE GROUP AND IMMUNOCOMPROMISED PATIENTS WITH BACTERIAL MENINGITIS

(i) Third-generation Cephalosporins

● Cefotaxime [A.1.5(i)] or Ceftriaxone [A.1.5(i)]

H.7 SHUNT-ASSOCIATED

(i) Cloxacillin [A.1.3(i)]

–If strong evidence of MRSA

(i) Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)]

For duration refer page 38

Think before you prescribe antibiotics

H. EMPIRICAL ANTIBIOTIC THERAPY FOR NEUROSURGERY (CONTD.) / J. ORTHOPAEDICS

H.8 COMPLICATED MENINGITIS

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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H.8 COMPLICATED MENINGITIS

(i) Aminoglycosides (Netilmicin) [A.2.2(ii)] + Third-generation Cephalosporins (Ceftriaxone) [A.1.5(i)]

H.9. BRAIN ABSCESS

(i) Tazobactam + Piperacillin [B.1.3(iv)] / (ii) With or without Metrogyl [A.1.4(iii)]

H.9.1 Postsurgical brain abscess: Look for evidence of infection, send pus cultures whenever possible, use

(i) Cloxacillin [A.1.3(i)] / Teicoplanin [B.3.2(iii)] / Vancomycin [B.3.2(iv)] + Third-generation Cephalosporins [A.1.5(i)]

J. EMPIRICAL ANTIBIOTIC THERAPY FOR ORTHOPAEDICS

J.1 CLEAN NON-INFECTED CASES WITH NO IMPLANTS

(i) Second-generation Cephalosporins

● Inj. Cefuroxime [D.1 (Choice II)] 1/2 hour before induction and 4 hours after surgery

J.2 CLEAN CONTAMINATED CASES WITH OR WITHOUT SOFT TISSUE MACERATION

(i) Inj. Cloxacillin [A.1.3(i)] + Mupirocin ointment locally

(ii) Inj. Clindamycin [A.1.3(ii)] + Inj. Gentamicin [A.2.2(i)] with or without Metrogyl [A.1.4(iii)]

J.2.1 Evidence of MRSA

(i) Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)]

J.2.2 Gas gangrene

(i) Penicillin G [A.1.3(iv)] in divided doses + Clindamycin [A.1.3(ii)]

For duration refer page 38–39

Start antibiotics after microbiology work-up

J. EMPIRICAL ANTIBIOTIC THERAPY FOR ORTHOPAEDICS / K. OBSTETRICS AND GYNAECOLOGY

J.3 ROAD TRAFFIC ACCIDENTS WITH EXTENSIVE INJURIES: SITE OF INJURY IMPORTANT

Drug	Available as	Dose	Contraindications	Special precautions	Drug interaction	Side-effects
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J.3. ROAD TRAFFIC ACCIDENTS WITH EXTENSIVE INJURIES

– Choice I

(i) Inj. Amikacin [A.2.2(i)] + Inj. Zosyn [B.1.3(iv)] + Inj. Metrogyl [A.1.4(iii)]

– Choice II

(ii) Inj. Amikacin [A.2.2(i)] + Inj. Cefpirom [A.2.5(iii)] + Inj. Metrogyl [A.1.4(iii)]

J.4 SURGERIES WITH MAJOR IMPLANTS

(i) Inj. Amikacin [A.2.2(i)] + Inj. Teicoplanin [B.3.2(iii)]/Inj. Vancomycin [B.3.2(iv)] with or without Metrogyl [A.1.4(iii)]

J.5 OSTEOMYELITIS: ANTIBIOTICS BASED ON CULTURE DATA X 4–6 WEEKS

K. EMPIRICAL ANTIBIOTIC THERAPY FOR OBSTETRICS AND GYNAECOLOGY

(i) Inj. Cloxacillin [A.1.3(i)] + Inj. Gentamicin [A.2.2(i)] with or without Metrogyl [A.1.4(iii)]

Look for evidence of infection and treat accordingly.

ANTIBIOTIC THERAPY FOR MEDICAL CASES

A. EMPIRICAL ANTIBIOTIC THERAPY FOR GENERAL MEDICINE

A.1 Community-acquired

A.1.1 COPD, Pneumonia: Betalactam with Betalactamase inhibitor [A.1.1(i)] with or without Levofloxacin [A.1.1(ii)]/Macrolide (Roxithromycin) [A.1.1(iii)]

A.1.2 Urinary tract infections: Nitrofurantoin [A.1.2(i)]/Nalidixic acid [A.1.2(ii)]. Confirm evidence of pyelonephritis and treat accordingly.

A.1.3 Skin and soft tissue/bone/joint: Cloxacillin [A.1.3(i)]/Clindamycin [A.1.3(ii)]/Cephalexin [A.1.3(iii)]. Necrotizing fasciitis: High-dose Penicillin [A.1.3(iv)] + Clindamycin [A.1.3(ii)]

A.1.4 Intra-abdominal and hepatobiliary: Oral Quinolones [A.1.4(i)] with Clindamycin [A.1.3(ii)]/with or without Metronidazole [A.1.4(iii)].

A.1.5 CNS: Ceftriaxone [A.1.5(i)] or refer to the guidelines under Medical Specialties.

A.2 Hospital-acquired

A.2.1 CNS: Third-generation Cephalosporins [A.1.5(i)]

A.2.2 Intra-abdominal and hepatobiliary: Netilmicin [A.2.2(i)] + Ofloxacin [A.1.4(i)] with or without Metronidazole [A.1.4(iii)]

A.2.3 Skin and soft tissue/bone/joint: Clindamycin [A.1.3(ii)]/Cephalexin [A.1.3(iii)]. Necrotizing fasciitis: High-dose Penicillin [A.1.3(iv)] + Clindamycin [A.1.3(ii)]

A.2.4 Urinary tract infection: Netilmicin [A.2.2(i)] + Ofloxacin [A.1.4(i)]

A.2.5 COPD, Pneumonia: Fluoroquinolone (Levofloxacin) [A.1.1(ii)]/Aminoglycoside (Amikacin) [A.2.2(i)] + Cefpirom [A.2.5(iii)] with or without Clindamycin [A.1.3(ii)].

B. EMPIRICAL ANTIBIOTIC THERAPY FOR MEDICAL SPECIALTIES

B.1 Respiratory disorders

B.1.1 Community-acquired pneumonitis (empirical therapy recommended): Betalactam + Betalactamase inhibitor [A.1.1(i)] with or without Macrolide [A.1.1(iii)]

B.1.2 Severe pneumonitis: Betalactam with Betalactamase inhibitor [A.1.1(i)] + Aminoglycoside [A.2.2(i)] with or without Clindamycin [A.1.3(ii)]

B.1.3 Ventilator-associated pneumonitis (VAP):

- Acquired before 5 days: Cefpirom [A.2.5(iii)] + Aminoglycoside (Amikacin) [A.2.2(i)] with or without Levofloxacin [A.1.1(ii)] (see also Annex V)

- Acquired after 5 days: Fluoroquinolone (Levofloxacin) [A.1.1(ii)]/Piperacillin + Tazobactam [B.1.3(iv)] with or without Clindamycin [A.1.3(ii)].

B.2 Gastrointestinal disorders:

B.2.1 Cholangitis: Netilmicin [A.2.2(i)] + Ofloxacin [A.1.4(i)]

B.2.2 Severe sepsis: Tazobactam + Piperacillin [B.1.3(iv)]

B.3 Renal septicemia/sepsis

B.3.1 Acute pyelonephritis (demonstrate pyuria): Ofloxacin [A.1.4(i)] + Netilmicin [A.2.2(i)].

B.3.2 Haemodialysis/vascular access-related sepsis: Cloxacillin [A.1.3(i)]/Clindamycin [A.1.3(ii)]. In case of

high chance of MRSA: Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)]

B.3.3 Septicaemia: Tazobactam + Piperacillin [B.1.3(iv)] with or without Clindamycin [A.1.3(ii)]

B.4 C.N.S.

B.4.1 Community-acquired bacterial meningitis in immunocompetent cases: Crystalline Penicillin [A.1.3(iv)] (via a central line and diluted in physiological solution)

B.4.2 Elderly age group and immunocompromised with bacterial meningitis: Cefotaxime/Ceftriaxone [A.1.5(i)]

B.4.3 Shunt associated: Cloxacillin [A.1.3(i)]. In case of strong clinical evidence of MRSA, Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)] + Amikacin [A.2.2(i)]

B.4.4 Complicated meningitis: Aminoglycoside (Netilmicin) [A.2.2(i)] + Third-generation Cephalosporins (Ceftriaxone) [A.1.5(i)]

B.4.5 Brain abscess: Tazobactam + Piperacillin [B.1.3(iv)]/Cefpirom [A.2.5(iii)] with or without Metroglol [A.1.4(iii)]

C. EMPIRICAL ANTIBIOTIC THERAPY FOR THE ICU

These guidelines are to be followed in the ICU.

Note: Choice of antibiotic in the ICU should be dependent on the underlying pathology.

C.1 Clean cases

Group 1: Clean cases admitted from outside directly to the ICU with no evidence of sepsis:
(i) No antibiotics to be administered

Group 2: Patients admitted to the ICU from outside on antibiotics with evidence of sepsis (clinical or otherwise). Change antibiotics after collecting samples for microbiological work-up.
(i) Augmentin [A.1.1(i)] + Amikacin [A.2.2(i)] for 48 hours. Review in light of investigations.

Group 3: Patients admitted to the ICU already on antibiotics with documented evidence of infection and showing improvement
(i) The same antibiotics to be continued unless proved otherwise.

Group 4: Patients transferred from the OT to the ICU
(i) The surgical antibiotic policy (p. 27) should be continued in the ICU unless there is evidence to the contrary and a change or withdrawal of antibiotics is required.

Group 5: Patients transferred from a floor of the hospital to the ICU
(i) Antibiotics as per the antibiotic policy for general medicine/medical specialties to continue.

C.2 Cases with evidence of sepsis needing ICU admission/already in the ICU

C.2.1 Community-acquired infections: the general medicine/medical specialties antibiotics policy shall be applicable.

C.2.2 Community-acquired pneumonia: Levofloxacin [A.1.1(ii)]

C.2.3 Nosocomial infections such as pneumonia, phlebitis, UTI (after sending cultures): Clindamycin [A.1.3(ii)] + Amikacin [A.2.2(i)] and Ofloxacin [A.1.4(i)]

Ventilator-associated pneumonia to be treated as above or Zosyn [B.1.3(iv)] + Amikacin [A.2.2(i)] [refer Annex V, page 39]

C.2.4 Severe phlebitis or device-associated septicemia: Teicoplanin [B.3.2(iii)] or Vancomycin [B.3.2(iv)] + Amikacin [A.2.2(i)]

ANTIBIOTIC THERAPY FOR SURGICAL CASES

D. EMPIRICAL ANTIBIOTIC THERAPY FOR SURGERY

Various clinical situations identified are:

- D.1 Clean cases
- D.2 Clean contaminated cases
- D.3 Contaminated/Septicaemia cases
- D.4 Surgical cases involving surgical implants

D.1 Clean cases: Only one dose recommended at the time of induction. Repeat second dose if surgery lasts for more than 4 hours.

Choice I

- (i) Betalactam (Amoxicillin) [D.1(i)] + Aminoglycosides (Gentamicin) [A.2.2(i)]

Choice II

- (i) First-generation Cephalosporins (Cefazolin) [A.1.3(iii)]/Second-generation Cephalosporins (Cefuroxime) [D.1 (choice II)]

Choice III

- (i) Consultant's own choice with justification

D.2 Clean contaminated cases

The following surgical situations were recognized:

- D.2.1 Road traffic accidents (RTA)
- D.2.2 Biliary and GI surgery
- D.2.3 Genitourinary system

Recommendations:

- D.2.1 Road traffic accidents: Assess the extent and site of injury.

Choice I

- (i) First-generation Cephalosporins [A.1.3(iii)]

Choice II

- (i) Betalactam + Betalactamase inhibitor (Augmentin/Ampicillin+Subactam) [A.1.1(i)] with or without Metronidazole [A.1.4(iii)]

- D.2.2 Biliary and GI surgery

Choice I: For routine surgery

- (i) Second-generation Cephalosporins (Cefuroxime) [D.1(Choice II)]/with or without Clindamycin [A.1.3(ii)]

Choice II

- (i) Zosyn [B.1.3(iv)]/Magnex with or without Metronidazole [A.1.4(iii)]

- D.2.3 Genitourinary system

- (i) Quinolones (Ofloxacin) [A.1.4(i)] + Aminoglycosides (Gentamicin) [A.2.2(i)]

Note: An alternative to Zosyn, which is a combination of a Betalactam antibiotic and Betalactamase inhibitor, could be Augmentin/Subactam but in our hospital setting the resistance ranges from 46% to 78% (ward isolates). Therefore, Magnex is being considered.

D.3. Contaminated/Septicaemia cases

The Resident flora and evidence of sepsis is likely to be known before surgery in this group of cases. If already on definitive therapy this can be continued preoperatively keeping in view the bioavailability of the drug while the tissue is under the knife. However, in case no antibiotics are being used, empirical therapy with Betalactam + Betalactamase inhibitor with or without Metronidazole should be considered. Therapy can also be based on presumed site or type of infection as below:

- D.3.1 Soft tissue infections—cover *Staph. aureus*

- D.3.2 GI infections—cover *E. coli* and anaerobes

- D.3.3 GU infections—cover *E. coli* and *Pseudomonas*

All efforts should be made to establish bacterial infection from pus, blood, body fluids, etc.

D.4. Surgical cases involving surgical implants

Choice I

- (i) Clindamycin [A.1.3(ii)] + Ofloxacin [A.1.4(i)]

Choice II

- (i) Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)] + Ofloxacin [A.1.4(i)]

Two doses recommended:

- Dose 1—at the time of induction of anaesthesia
- Dose 2—4 hours after surgery

E. EMPIRICAL ANTIBIOTIC THERAPY FOR TRANSPLANT SURGERY

Major transplant groups identified are:

E.1 Renal transplant

- 1.1 Recipient: presumed to be a clean case. First-line (empirical) therapy suggested. Inj. Cefuroxime [second-generation Cephalosporins [D.1(Choice II)].

Only 2 doses are recommended.

- Dose 1—half hour before surgery, at the time of induction of anaesthesia
- Dose 2—4 hours after surgery

- E.1.2 Donor: as above

- E.1.3 Graft nephrectomy

Antibiotics suggested: Inj. Ofloxacin [A.1.4(i)] + Inj. Gentamicin [A.2.2(i)].

Only 2 doses are recommended.

- Dose 1—half hour before surgery at the time of induction

- Dose 2—4 hours after surgery

- E.1.4 Native nephrectomy: the definitive therapy is already known in such cases; in case of infection, therefore, a policy is not required.

- E.1.5 CAPD: Clindamycin [A.1.3(ii)] + Gentamicin [A.2.2(i)]

In case of strong suspicion of MRSA, instead of Clindamycin [A.1.3(ii)], Teicoplanin/Vancomycin [B.3.2(iii)/B.3.2(iv)] can be used.

E.2 Liver transplant: Elective treatment

- (i) Zosyn [B.1.3(iv)] and Teicoplanin [B.3.2(iii)]. Two doses are recommended. Other antibiotics can be continued such as: Fluconazole [E.2(ii)], INH [E.2(iii)] and Septran [E.2(iv)]. Monitor CMV using NASBA assay at first indication before start of therapy for CMV [E.2(v)].

E.3 Cadaveric and semi-elective transplant: Both liver and renal transplant. A combination of Meropenem and Teicoplanin can be used.

- (i) Meropenem [E.3(i)] + Teicoplanin [B.3.2(iii)], only 2 doses recommended + other antibiotics as in E.2(i) [liver transplant] above.

F. EMPIRICAL ANTIBIOTIC THERAPY FOR CVT AND CARDIAC SURGERY

- (i) Inj. Ofloxacin [A.1.4(i)] and
(ii) Clindamycin [A.3(ii)]/Teicoplanin [B.3.2(iii)] (MRSA)

Two doses pre- and postoperatively

- Dose 1—half hour before surgery, at the time of induction of anaesthesia
- Dose 2—4 hours after surgery

However, the antibiotic can be continued till the last line is out unless proved otherwise.

The above therapy is for patients who are not on any antibiotics and have no evidence of sepsis preoperatively.

G. EMPIRICAL ANTIBIOTIC THERAPY FOR PAEDIATRIC SURGERY

G.1 Day-care surgery

- G.1.1 Clean cases (hernia, circumcision, orchidopexy): Single dose of Inj. Cefuroxime [D.1 (Choice II)] before or at the time of induction

G.2 Older children (major cases)

G.2.1 Clean, clean-contaminated cases:

— **Choice I**

- (i) Second-generation Cephalosporins [D.1 (Choice II)] + Gentamicin [A.2.2(i)]

— **Choice II**

- (i) Cloxacillin [A.1.3(i)] + Gentamicin [A.2.2(i)]

Two doses recommended one at the time of induction and the second after 4–6 hours.

G.2.2 Contaminated cases:

— **Choice I**

- (i) Third-generation Cephalosporins [A.1.5(i)] + Gentamicin [A.2.2(i)]

— **Choice II**

- (i) Amikacin [A.2.2(i)] + Metronidazole [A.1.4(iii)]

G.3 Neonatal surgery

G.3.1 Clean cases: Second-generation Cephalosporins [D.1 (Choice II)] + Gentamicin [A.2.2(i)]

G.3.2 Clean contaminated cases: Third-generation Cephalosporins [A.1.5(i)] + Aminoglycoside (Gentamicin/Amikacin) [A.2.2(i)]

G.3.3 Contaminated cases: Third-generation Cephalosporins [A.1.5(i)] + Aminoglycosides (Gentamicin/Amikacin) [A.2.2(i)] + Metronidazole [A.1.4(iii)]

G.4 Special situations

G.4.1 MRSA/MRSE: Vancomycin [B.3.2(iv)]/Teicoplanin [B.3.2(iii)]

G.4.2 Prophylaxis for UTI

- Co-trimoxazole (Septran) [E.2(v)]/Nitrofurantoin [A.1.2(i)]
- Cephalixin [A.1.3(iii)] (for babies up to 3 months)

H. EMPIRICAL ANTIBIOTIC THERAPY FOR NEUROSURGERY

Note: No antibiotics for clean cases other than chemoprophylaxis.

H.1 Routine use: Cloxacillin [A.1.3(i)] + Gentamicin [A.2.2(i)]

H.2 Fracture skull with CSF leak: No routine use of antibiotics. Look for evidence of infection and use evidence-based definitive therapy.

H.3 Neurosurgery lasting less than 4–6 hours: Single dose of second-generation Cephalosporins (Cefuroxime) [D.1 (Choice II)] before induction.

H.4 Neurosurgery lasting more than 6 hours (2 doses): Second-generation Cephalosporins [D.1 (Choice II)] + Amikacin [A.2.2(i)]. First dose with induction and second dose after 8 hours.

H.5 Community-acquired bacterial meningitis in immunocompetent cases: Crystalline Penicillin (via a central line and diluted in physiological solution) [A.1.3(iv)]

H.6 Elderly age group and immunocompromised patients with bacterial meningitis: Cefotaxime [A.1.5(i)]/Ceftriaxone [A.1.5(i)] (third-generation Cephalosporins)

H.7 Shunt-associated: Cloxacillin [A.1.3(i)] (in case of strong clinical evidence of MRSA, Teicoplanin [B.3.2(iii)]/Vancomycin) [B.3.2(iv)]

H.8 Complicated meningitis: Aminoglycosides (Netilmicin) [A.2.2(i)] + Third-generation Cephalosporins (Ceftriaxone) [A.1.5(i)]

H.9 Brain abscess: Tazobactam + Piperacillin [B.1.3(iv)] with or without Metrogyl [A.1.4(iii)]

H.9.1 Postsurgical brain abscess: Look for evidence of infection, send pus cultures whenever possible, use Cloxacillin [A.1.3(i)]/Teicoplanin [B.3.2(iii)]/Vancomycin [B.3.2(iv)] + Third-generation Cephalosporins [A.1.5(i)]

J. EMPIRICAL ANTIBIOTIC THERAPY FOR ORTHOPAEDICS

J.1 Clean non-infected cases with no implants

Inj. Cefuroxime (Second-generation Cephalosporins) [D.1 (Choice II)] 1/2 hr before induction and another dose 4 hours after surgery.

J.2 Clean contaminated cases with or without soft tissue maceration

- Inj. Cloxacillin [A.1.3(i)] + Mupirocin ointment locally
- Inj. Clindamycin [A.1.3(ii)]/Inj. Gentamicin [A.2.2(i)] with or without Metrogyl [A.1.4(iii)]

J.2.1 Evidence of MRSA: Teicoplanin/Vancomycin [B.3.2(iii)]/[B.3.2(iv)] instead of Inj. Cloxacillin [A.1.3(i)] + Inj. Gentamicin [A.2.2(i)]

J.2.2 Gas-gangrene: Penicillin G [[A.1.3(iv)] + Clindamycin [A.1.3(iii)]

J.3 Road traffic accidents with extensive injuries: Site of injury important

— **Choice I**

Inj. Amikacin [A.2.2(i)] + Inj. Zosyn [B.1.3(iv)] + Inj. Metrogl [A.1.4(iii)]

— **Choice II**

Inj. Amikacin [A.2.2(i)] + Inj. Cefpirom [A.2.5(iii)] + Inj. Metrogl [A.1.4(iii)]

J.4 Surgeries with major implants: Inj. Amikacin [A.1.4(i)] + Inj. Teicoplanin/Vancomycin [B.3.2(iii)]/[B.3.2(iv)] with or without Metrogl [A.1.4(iii)]

J.5 Osteomyelitis: Antibiotics for 4–6 weeks based on culture data

K. EMPIRICAL ANTIBIOTIC THERAPY FOR OBSTETRICS AND GYNAECOLOGY

Inj. Cloxacillin [A.1.3(i)] + Inj. Gentamicin [A.2.2(i)] with or without Metrogl [A.1.4(iii)]

Look for evidence of infection and treat accordingly.

Note: The above has been based on the prevailing antibiogramme of the hospital. Though not much choice is left, Cephalosporins have been deliberately given a break other than for neurological indications. For *Staphylococcus*, Cloxacillin is the drug of choice unless MRSA is suspected. For MRSA, Teicoplanin/Vancomycin is the only choice, even if sensitivity to another antibiotic is mentioned.

We should discourage continued admission of reservoirs of infections where hospital admission is not going to change the outcome of their disease. Such patients can change the bacterial ecology of our hospital.

Good evidence of sepsis is a positive blood culture if collected with adequate fill as per the recommendations.

Hand-washing in between examining patients is the hallmark of controlling nosocomial infections. Items used on patients should be taken more seriously for control and spread of infection rather than fomites. Barrier nursing reinforces the control of nosocomial infection.

CANDIDA INFECTIONS

Candida infections should not be ignored and must be investigated further for their significance.

Systemic candidaemia: Patients who took septicæmic clinically and have culture-negative septicæmia but *Candida* isolated from one or other body sites such as oral or mucocutaneous sites, candiduria or device-associated infection should be presumed to have candidal septicæmia and treated accordingly. Systemic *Candida* infection once diagnosed should be treated adequately with Amphotericin B in the dosage of 0.7–1 mg/kg body weight/day till a total dose of 5–7 mg/kg body weight/2.5 g of Amphotericin B is given to the patient.

Candiduria

10³ orgs (CFU)/ml of yeast cells in the urine along with pus cells is significant. Treat with Fluconazole, 200 mg first day followed by 100 mg/day x 4 or Amphotericin B i.v. 0.3 mg/kg body weight. Single dose or as intermittent bladder washes with 5 mg/100 ml water at 42 ml/hr x 1–2 days.

(Amphotericin B should be diluted in water or dextrose, but not in normal saline as electrolytes inhibit its action.)

In line-associated *Candida* infections with negative blood cultures, give Amphotericin B 500 mg (total dose) over 10 days.

Candida spp other than *Candida albicans*, have been found to be more resistant to Fluconazole, and thus should be treated with Amphotericin B. The choice between liposomal and non-liposomal Amphotericin B should be made keeping in view the cost implication and the need to achieve immediate blood levels. The advantage of using liposomal Amphotericin B (3–5 mg/kg body weight/day i.v. given over 1–2 hours) is that it is less toxic and gets concentrated in the reticuloendothelial system, but the disadvantage is that the levels take a few days to build up. Start with non-liposomal Amphotericin B and later switch to liposomal Amphotericin B for maintenance.

Renal toxicity is dose-related and should be given by slow infusion. Any adverse reactions can be managed by reducing the dose and giving antihistaminics.

MYCOBACTERIA OTHER THAN *M. tuberculosis*

<i>Mycobacterium avium</i> complex	First choice	Other options	Comments
HIV-negative	Clarithromycin: 500 mg p.o. b.d. x 6 months <i>plus</i> Ethambutol: 15 mg/kg p.o. q.i.d. x 6 months		Disease among HIV-negative individuals is almost always pulmonary. Most studies involved late-stage HIV-infected patients. Regimen for HIV-infected individuals should include either Clarithromycin or Azithromycin and will be lifelong
HIV-infected	Clarithromycin: 500 mg p.o. b.d. <i>plus</i> Ethambutol: 15 mg/kg p.o. q.i.d.	Azithromycin Ciprofloxacin Rifabutin (or rifampin)	
<i>Mycobacterium chelonae</i>	Clarithromycin: 500 mg p.o. b.d. x 6 months	Amikacin Cefoxitin	
<i>Mycobacterium fortuitum</i>	Amikacin: 15 mg/kg/day x 2–6 weeks <i>plus</i> Cefoxitin: 200 mg/kg/day x 2–6 weeks <i>plus</i> Probenecid: 500 mg p.o. q.i.d. x 2–6 weeks	TMP/SMX Clarithromycin Erythromycin	Patients should have surgical excision of infected areas. Following 2–6 weeks of intravenous therapy, if the organism is susceptible to oral antimicrobials, the patient should be switched to oral therapy for 2–6 months
<i>Mycobacterium kansasii</i>	Rifampin: 600 mg p.o. x 12–18 months <i>plus</i> Ethambutol: 20 mg/kg p.o. q.i.d. x 12–18 months		
<i>Mycobacterium marinum</i>	Ethambutol 20 mg/kg p.o. q.i.d. x 6 months <i>plus</i> Rifampin: 600 mg p.o. q.i.d. x 6 months	Minocycline Clarithromycin	No consensus on recommended duration of therapy. Recent review recommends a minimum of 6 months

TMP/SMX: Trimethoprim/Sulphamethoxazole

FEVER OF UNKNOWN ORIGIN (FUO)**Definition**

- Duration ≥ 3 weeks
- Fever $>101^{\circ}\text{F}$ or $>38.5^{\circ}\text{C}$ on more than one occasion
- No diagnosis despite 1 week of intensive inpatient evaluation

Causes

- The list is extensive, but the following are some of the more common causes. In general, it is more likely to be a *subtle manifestation of a common disease*, rather than an uncommon disease.
- In a patient with known malignancy: 50% due to infections (usually during neutropenia) and 50% due to tumour itself
- In patients with HIV: 75% infections, rarely due to HIV itself
- 5%–15% of cases undiagnosed, most spontaneously defervesce

Category	Causes
Infection	Tuberculosis: disseminated or extrapulmonary disease can have normal CXR, PPD, sputum AFB; biopsy (lung, liver, bone marrow) for granulomas has 80%–90% yield in miliary disease Endocarditis: consider <i>Haemophilus</i> , <i>Bartonella</i> , <i>Legionella</i> and <i>Coxiella</i> Intra-abdominal abscess: hepatic, splenic, pancreatic, perinephric, pelvic, prostatic Osteomyelitis CMV, EBV, Lyme disease, malaria, babesiosis, amoebiasis
Neoplasm	Lymphoma: lymphadenopathy, hepatosplenomegaly, \downarrow Hct or \uparrow Plt, \uparrow LDH Renal cell carcinoma: microscopic haematuria, \uparrow Hct Hepatic cell carcinoma, pancreatic cancer Atrial myxomas: obstruction, embolism, constitutional symptoms Leukaemia, myelodysplasia
Connective tissue disease	Temporal (giant cell) arteritis: headache, scalp pain, jaw claudication, visual disturbances, \uparrow ESR Adult-onset Still's disease (juvenile rheumatoid arthritis): fever with evanescent: salmon-coloured macular truncal rash during fever may precede arthritis Polyarteritis nodosa RA, SLE, sarcoidosis
Miscellaneous	Drugs, fasciitis, haematoma, thyroid, familial Mediterranean fever

Work-up

- History: infectious contacts, travel, pets, occupation, medications, thorough review of systems, TB history
- Discontinue unnecessary medications
- Careful physical examination with attention to skin, murmurs, hepatosplenomegaly, arthritis
- Laboratory evaluation
CBC with differential, electrolytes, BUN, Cr, LFT, ESR, ANA, RF
BCx x 3 sets (off antibiotics), urine examination, urine culture, PPD, heterophile Ab, CMV antigenaemia test (NASBA), HIV
- Imaging studies: CXR, abdominal CT (oral and IV contrast), U/S, ? tagged WBC or gallium scan
- Temporal artery bx if \uparrow ESR and age >60 years
- ? Bone marrow bx or liver bx (especially if \uparrow AP): even without localizing signs or symptoms, yield may be up to 15%

Treatment

- Empirical antibiotics not indicated (unless patient neutropenic)

ASEPTIC MENINGITIS**Definition**

- Negative bacterial microbiologic data, CSF pleocytosis *without* predominance of polymorphs
- Misnomer "aseptic" only in the sense that it is less likely to be acute bacterial meningitis, but can be due to both infectious and non-infectious causes

Causes

- Viral enteroviruses, HIV, HSV (type 2 more common than 1), mumps, lymphocytic choriomeningitis virus, encephalitis viruses (e.g. Eastern, Western, St Louis, California, adenovirus, CMV, EBV)
- Tuberculosis, fungal, spirochaetal (Lyme disease, syphilis, leptospirosis) rickettsial, *Coxiella*, *Ehrlichia*
- Partially treated bacterial meningitis
- Parameningeal focus of infection (e.g. brain abscess, epidural abscess, septic thrombophlebitis of dural venous sinuses, or subdural empyema)
- Medications: TMP/SMX, NSAIDs, Penicillin, Isoniazid
- Systemic illness: SLE, sarcoidosis, Behcet's, Sjögren's syndrome, rheumatoid arthritis
- Neoplasms, intracranial tumours (or cysts), lymphomatous or carcinomatous meningitis

BACTERIAL ENDOCARDITIS**Definition**

- Infection of the endothelium of the heart (including but not limited to the valves)
- Acute (ABE): infection of normal valves with a virulent organism (e.g. *Staph. aureus*)
- Subacute (SBE): indolent infection of abnormal valves with a less virulent organism (e.g. *S. viridans*)

Predisposing conditions

- Abnormal valve: rheumatic valvular disease, MVP with MR, bicuspid or calcific aortic valve, prosthesis
- Abnormal risk of bacteraemia, indwelling venous catheters

Microbiology of endocarditis**Aetiology**

- *S. viridans*
- Other streptococci
- *Enterococcus*
- *Staph. aureus*
- *S. epidermidis*
- Gram-negative bacilli
- Other
- Culture-negative

Diagnostic studies

- Blood cultures (before initiation of antibiotics) at least 3 sets (aerobic and anaerobic bottles) from different sites, ideally spaced at least one hour apart. Check surveillance blood cultures (at least 2 sets) after appropriate antibiotics have been initiated to document clearance; repeat every 24–48 hours until negative.

Treatment

- Obtain culture data first
- ABE—antibiotics should be started promptly after culture data are obtained.
- SBE—if patient is haemodynamically stable, antibiotics may be delayed in order to properly obtain adequate blood culture data, especially in the case of prior antibiotic treatment.
- Suggested empirical therapy

native valve ABE: [Cloxacillin + Gentamicin] or [Teicoplanin/Vancomycin + Gentamicin] if high prevalence of MRSA

native valve SBE: Penicillin/Ampicillin + Gentamicin

prosthetic valve: Teicoplanin/Vancomycin + Gentamicin

- Adjust antibiotic regimen based on organism and sensitivity
- Repeat blood cultures q.i.d. until patient defervesces
- Fever may persist up to one week after appropriate antibiotic therapy is instituted
- Systemic anticoagulation is relatively *contraindicated* given the risk of haemorrhagic cerebral embolic events
- Duration of therapy is usually 4–6 weeks (with the AG used only for the first 2 weeks), except in cases of uncomplicated right-sided endocarditis, in which 2 weeks of therapy may have comparable outcomes.

DIAGNOSTIC CRITERIA OF VAP

CDC criteria

≥3 of the following criteria:

1. Rectal temperature >38°C or <35.5°C
2. Blood leucocytosis >10x10⁹/L and/or left shift or leucopenia <3x10⁹/L
3. Ten leucocytes per high power field in Gram stain of endotracheal aspirate
4. Positive culture from endotracheal aspirate
and

New, progressive or persistent radiographical infiltrate

CPIS

i Temperature (°C)	≥36.5 and <38.4	0 point
	≥38.5 and <38.9	1 point
ii Blood leucocytosis, (mm ³)	≥39.0 and <36.0	2 points
	>4000 and <11 000	0 point
iii Tracheal secretions	<4000 and >11 000	1 point
	band forms ≥500	1 point
iv Oxygenation: PaO ₂ /FiO ₂ , (mmHg)	<14 WBC	0 point
	≥14 WBC	1 point
v Pulmonary radiography	+ purulent sputum	+1 point
	>240 or ARDS	0 point
iv Culture of tracheal aspirate (semi-quantitatives: 0–1–2 or 3+)	≤240 and no ARDS	2 points
	No infiltrate	0 point
Pathogenic bacteria cultured	Diffuse or patchy infiltrate	1 point
	Localized infiltrate	2 points
	≤1 or no growth	0 point
	>1+	1 point
	>1+ and same pathogenic bacteria seen in Gram stain	2 points

Total points = CPIS, varies from 0 to 12 points, >6 points is pneumonia

Memphis criteria

I. Probable pneumonia

CDC criteria and

1. Radiographical pulmonary abscess and positive needle aspirate culture
2. Open lung biopsy or post-mortem histological examination of lung tissue suggestive of pneumonia, but with insignificant culture results
3. Positive culture of blood and pleural fluid
4. Positive quantitative culture of BAL or PSB specimen

II. Definite pneumonia

CDC criteria and

1. Positive quantitative culture of lung parenchyma (>10⁴) via open-lung biopsy or post-mortem
2. Open lung biopsy or post-mortem histological examination of lung tissue

SUGGESTED DURATION OF ANTIBIOTIC THERAPY IN IMMUNOCOMPETENT PATIENTS

Clinical situation		Duration of therapy (days)
Site	Clinical diagnosis	
Bacteraemia	Bacteraemia with removable focus (no endocarditis)	10–14 (<i>Clin Inf Dis</i> 1992;14:75)
Bone	Osteomyelitis, adult; acute	42
	adult: chronic	Until ESR normal (often >3 months)
	child: acute, <i>Staphylococcus</i> and <i>Enterobacteriaceae</i>	21
	child: acute; <i>Meningococcus</i> , <i>Haemophilus</i>	14
Ear	Otitis media with effusion	10 (or 1 dose Ceftriaxone)
	Recent meta-analysis suggests 5 days of 'short-acting' antibiotics effective for uncomplicated otitis media (<i>JAMA</i> 1998;279:1736).	
Endocardium	Infective endocarditis, native valve <i>Streptococcus viridans</i> <i>Enterococci</i> <i>Staph. aureus</i>	14 or 28 28 or 42 14 (R-sided only) or 28
Gastrointestinal	Bacillary dysentery (shigellosis)/ traveller's diarrhoea	3
	Typhoid fever (<i>S. typhi</i>): Ceftriaxone FQ (Ofloxacin) Chloramphenicol	5
		3–5
		14
	<i>Helicobacter pylori</i>	10–14
Pseudomembranous enterocolitis (<i>C. difficile</i>)	10	
Genital	Non-gonococcal urethritis or Pelvic inflammatory disease	7 days Doxy or single dose Azithro 14
Heart	Pericarditis (purulent)	28
Joint	Septic arthritis (non-gonococcal) Adult	14–28 (<i>Lancet</i> 1998;351:197)
	Infant/child	Rx as osteomyelitis above
	Gonococcal arthritis/disseminated infection	7
Kidney	Cystitis (bladder bacteriuria)	3
	Pyelonephritis Recurrent (failure after 14 days rx)	14 (7 days if Cipro used) 42
Lung	Pneumonia: pneumococcal	Until afebrile 3–5 days (minimum 5 days)
	Pneumonia: <i>Enterobacteriaceae</i> or <i>Pseudomonas</i>	21, often up to 42
	Pneumonia: staphylococcal	21–28
	<i>Pneumocystis carinii</i> , in AIDS; other immunocompromised	21 14
	<i>Legionella</i> , <i>Mycoplasma</i> , <i>Chlamydia</i>	14–21
	Lung abscess	Usually 28–42

Meninges	<i>N. meningitidis</i> <i>H. influenzae</i> <i>S. pneumoniae</i> <i>Listeria meningoencephalitis</i> , gp B <i>Streptococcus</i> , coliforms	5–7 (IDCP 1998; 7:370) 7 10–14 14–21 (longer in immunocompromised)
Multiple systems	Brucellosis Tularemia	42 (add SM or GM for 1st 7–14 days) 7–14
Muscle	Gas gangrene (<i>Clostridia</i>)	10
Pharynx	Group A streptococci pharyngitis	10 (O Ceph 2/3, Azithro 5)
Also see	Diphtheria (membranous)	7–14
	Carrier	7
Prostate	Chronic prostatitis (TMP/SMX) (F Q)	30–90 28–42
Sinuses	Acute sinusitis	10–14
Skin	Cellulitis	Until 3 d. after acute inflammation disappears
Systemic	Rocky Mountain spotted fever	Until afebrile for 2 days

4. The recommended duration is a minimum or average time and should not be construed as absolute. Azithro = azithromycin; Cipro = ciprofloxacin; Doxy = doxycycline; ESR = erythrocyte sedimentation rate; FQ = fluoroquinolones; GM = gentamicin, rx = treatment; SM = streptomycin; TMP/SMX = trimethoprim/sulfamethaxazole; Ceph = Cephalixin


