Preface

There is a growing consensus among Infectious Disease Specialists universally that time may be running out for antimicrobial efficacy. For too long clinicians have used these precious drugs empirically and randomly, creating a microcosm of resistant bugs. The Infectious Disease Society of Pakistan (IDSP) advocates rational prescription of antimicrobials based on principles of good clinical practice. We are pleased to present *Guidelines for antimicrobial use* as a quick reference guide to clinicians of all disciplines. Only generic names of antimicrobials are being used.

The "Guidelines" is by no means comprehensive and is in no way a substitute for reading and understanding pharmacodynamics. We strongly discourage use of antibiotics as a prescription for undiagnosed fevers, or presumptive or proven viral infections. Precise diagnosis using all available clinical methods, and supplemented with microbiological proof of bacterial infection is emphasized. Fungal, viral and mycobacterial infections must be searched for carefully as treatment and outcome depend entirely on precise diagnosis. Non infectious disease cause of fevers must be ruled out.

IDSP strongly advocates infection control as a means of limiting spread of infection and acquisition of drug resistance. Hand washing between patients is a proven method of preventing nosocomial infections, as well as an established deterrent against food borne diseases.

Surgeons are advised against excessive and prolonged use of antibiotics before or during surgery. All too often unnecessary antibiotics are prescribed in the name of "prophylaxis." Universal guidelines suggest selective use for short term administration, in addition to strict hygienic principles of pre operative scrubbing.

Several experts and members of the National Task Force have contributed towards making the *Guidelines* possible. I would like to acknowledge their contribution: Drs. Faisal Sultan, Yasser Hussain, Brigadier Muzammil H. Najmi, Altaf Ahmed, Sajid Maqbool, Rumina Hasan, Faisal Mahmood and Farheen Ali. We also applaud the support and encouragement of Dr.Huma Qureshi, Chairperson National Taskforce and Executive Director, Pakistan Medical Research Council.

Dr. Naseem Salahuddin
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Message

Without doubt infectious diseases (IDs) are the leading cause of mortality and morbidity in the developing countries. Regionally, and closer to home the pattern of ID is quite different from that seen in developed countries of the world. Yet, ironically, we use textbooks and periodicals that are based in USA or Europe. Due to sheer apathy data gathering of our own diseases has been insufficient. In September 1993 a group of like-minded physicians formed the Karachi ID Society. In March 1999, the Society was renamed Infectious Diseases Society of Pakistan (IDSP).

Many of the objectives of IDSP have been met over the course of years. Recently IDSP after its long effort was able to convince CPSP successfully to commence Infectious Diseases fellowship.

In 1994 IDSP started a newsletter that has subsequently expanded to a quarterly Infectious Diseases Journal of Pakistan (IDJP) which is recognised by PMDC. The journal is widely circulated and continues to give valuable information. IDSP has been holding Conferences and seminars in various institutions in different cities. Cases are presented and discussed by experts in the field. The IDSP functions as a think tank. Any physician, clinical or non-clinical, nurses and any graduate of science with interest in ID may apply for the membership.

Guidelines for antimicrobial use is another one

of our efforts to bring information on how to select antimicrobials in infection to health care providers at all levels of practice. It will serve to provide maximum benefit to their patients, reduce morbidity and mortality, save on expensive medical care, and prevent emergence of drug resistance. I fully appreciate the effort of our team, and I give special thanks to Dr. Naseem Salahuddin for her enormous input into writing the *Guidelines*.

Dr. Altaf Ahmed
President IDSP

Message

It gives me great pleasure to welcome *Guidelines for antimicrobial use* as a quick reference guide to clinicians of all disciplines. I am sure this will be of great help to clinicians in selecting appropriate antimicrobial agents according to the nature of the infection and thereby rationalizing its use and reducing misuse.

The efforts of members of National Taskforce on Antimicrobial Resistance Containment Programme, Infectious Disease Society of Pakistan and Pakistan Antimicrobial Resistance Network in general and Dr Naseem Salahuddin in particular need to be appreciated in the development of this important document. It is hoped that this booklet will achieve its purpose of promoting prudent and rational antibiotic prescription.

Dr. Huma Qureshi
Executive Director
Pakistan Medical Research Council/
Chairperson
National Taskforce on
Antimicrobial Resistance
Containment Programme

Introduction to Pakistan Antimicrobial Resistance Network (PARN)

High levels of antimicrobial resistance (AMR) and frequency of health care associated infections (HAI) in Pakistan are a significant cause of concern. Pakistan Antimicrobial Resistance Network (PARN) was set up in March 2007 in association with the Infectious Diseases Society of Pakistan (IDSP). PARN is a coalition of individuals, organisations and public health agencies concerned about antibiotic resistance and health care associated infections with the specific aim of creating awareness through sharing of information and development of a support group to help address these issues. In October 2007 the need to contain antimicrobial resistance in the country was emphasised by the Government of Pakistan through notification of a National Task Force and Advisory Group for "Antimicrobial Resistance Containment Programme". The Task Force with representation from public and private health sectors (including PARN and IDSP) and Dr. Huma Qureshi (Executive Director PMRC) as it's Chairperson has begun work in a number of areas.

The launch of the *Guidelines for Antimicrobial Use*, one of the first achievements of the Task Force, is a significant landmark in promoting appropriate antimicrobial usage. We are hopeful that these guidelines will prove useful in day to day practice. Furthermore, that adherence to good antimicrobial prescribing practices combined with implementation of infection control measures will contribute to reducing the burden

of antimicrobial resistance in our community.

On behalf of Pakistan Antimicrobial Resistance Network I would like to warmly thank Dr. Huma Qureshi who is not only a strong advocate of appropriate antimicrobial use, but has also put in an enormous effort towards motivating and leading the Task Force. We would also like to thank the Ministry of Health for their tremendous support towards containment of antimicrobial resistance in the country. Finally, heartiest gratitude and appreciation to Dr. Naseem Salahuddin and her team for their hard work in preparing these guidelines.

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Fundamentals of Good Clinical Practices in Infectious Diseases

The *Guidelines for antimicrobial use* is intended to serve as an educational tool for antimicrobial use as *empiric therapy, and not as a substitute for definitive proper culture and sensitivity reported treatment.* It is meant to promote selective, cost effective use of antimicrobials, and aims to help decrease the emergence of resistant organisms in the community as well as in the hospital setting.

There exists a wide spectrum of antimicrobial agents available for therapy. One must take into consideration not only likely microbiologic causes, but toxicity, drug penetration, interactions and cost as well.

This guide is not a comprehensive treatise. Not every patient will fit these guidelines. When faced with a therapeutic dilemma, an Infectious Disease specialist or Clinical Microbiologist should be consulted.

Use of Antibiotics in Pregnancy

Safe and effective use of antimicrobial chemotherapy during pregnancy and lactation is dependent on knowledge, expertise and discretion of the prescriber. All antimicrobials diffuse across the placenta to a variable extent and in case of most drugs, the concentration in the fetus is comparable to that in the maternal plasma. (See page 34)

Important recommendations:

a) Appropriate cultures must be sent before institution of antibiotic therapy, e.g. typhoid fever is frequently missed or over diagnosed by not performing timely blood culture before instituting antibiotics. Serologic tests for diagnosis of typhoid fever are of very little value and are often misleading.

b) 2 sets of blood cultures should be sent, one from each arm. At least 10 ml of blood should be drawn for each set after proper skin cleansing.

c) Urine must be a clean catch mid stream specimen.

d) Open wounds should be cleaned with normal saline and culture should be taken from within the wound or freshly expressed pus. Superficial wound swabs should be avoided as the isolate may reflect skin flora.

e) Sputum and tracheal isolates do not necessarily represent parenchymal infection. Colonization and contamination must be considered and judged clinically.

f) Surgical specimens for culture should be sent in a syringe if there is pus, or in normal saline if it is tissue.

g) Culture results must be followed up and antibiotic selection should be reviewed and adjusted accordingly.

h) Distinction should be made between pathogens, colonizers and contaminants.

i) In the absence of positive cultures, antibiotics used empirically should be reviewed after 72 hours for consideration of further continuation or adjustment.

j) Viral infections such as URI, measles, mumps, rubella, varicella etc do not require antibiotics.

k) Drug fever may be considered if the fever persists despite correct and optimum therapy

l) The following antimicrobials must not be started without prior consultation with, preferably, an ID physician, Clinical Microbiologist or at least the primary consultant.

i.	Acyclovir	ii.	Amphotericin B
iii.	Amikacin	iv.	Ceftazidime
v.	Cefoperazone		
vi.	Cefoperazone/Sulbactam		
vii.	Cefipime	viii.	Fluconazole
ix.	Voriconazole	x.	Posaconazole
xi.	Ímipenem	xii.	Meropenem
xiii.	Ertapenem	xiv.	Moxifloxacin
xv.	Piperacillin/Tazobactam		
xvi.	Polymyxin B	xvii.	Teicoplanin
xviii.	Tobramycin	xix.	Vancomycin
xx.	Tigecycline	xxi.	Ethionamide
xxii.	Cycloserine		

Empirical Antibiotic Prescribing Guidelines

CNS Infections

Disease	Likely Pathogens	Preferred Antibiotics	Pediatric Dose	Comments
Acute bacterial meningitis (ABM) Age: 18-50 yrs	S. pneumoniae, N. meningitidis, H. influenzae (less likely)	Ceftriaxone 2 gm IV q12h + Dexamethasone 0.4 mg/kg q12h x 2 days or 0.15 mg/kg IV q 6h x 4 days	2mos onwards: Strep.pneumo, HiB, N.meningitidis Cefotaxime 150mg/kg/day q 6-8h or Ceftriaxone 50-75mg/kg/day q 8h + Ampicillin 100-200mg/kg/day q 6 h + Dexamethasone 0.6 mg/kg/day q 6h x 4 days	-1st dose of Dexamethasone should be given immed. after csf drawn. Give 1st dose of antibiotic 15-20 mts later. -IV Vancomycin (500-750mg q6h) to be considered along with Ceftriaxone if PRSP a concern*.

CNS Infections

Disease	Likely Pathogens	Preferred Antibiotics	Pediatric Dose	Comments
Acute bacterial meningitis (ABM) Age: >50 yrs, Immunocompromised	S. pneumoniae, Gram-negative bacilli Listeria monocytogenes	Ceftriaxone 2 gm IV q 12h + Ampicillin 2.0 gm IV q 4h + Dexamethasone 0.4 mg/kg q 12h x 2 days		Treatment for ABM should be continued till full clinical recovery (generally 10-14 days).
Acute bacterial meningitis (ABM) Post-neurosurgery Post head trauma	S. pneumoniae, S. aureus, Gram-negative aerobes including P.aeruginosa	Vancomycin 1.0 gm IV q 8-12h + Ceftazidime 2.0 gm IV q 8h	Vancomycin 15-60 mg/kg/day q 8-12h + Ceftazidime 150mg/kg/day q 8 h	-Continue Vancomycin till MRSA ruled out. -If S. Pneumoniae* isolated switch to Ceftriaxone.
Acute bacterial meningitis (ABM) Meningitis HIV infected	Community acquired pathogens, Listeria monocytogenes, Mycobacteria TB, Cryptococcus neoformans, Syphilis	Ceftriaxone 2 gm IV q 12h + Ampicillin 2.0 gm IV q 4h		-Initial gram stain may provide clues for likely pathogen. -Send CSF/serum for cryptococcal antigen. For treatment of unusual organisms consult ID expert.

CNS Infections

Disease	Likely Pathogens	Preferred Antibiotics	Pediatric Dose	Comments
Chronic Meningitis	M. tuberculosis, Cryptococcus, HSV (Mollaret's meningitis), neoplastic, connective tissue disorders	-Treatment depends on etiology		For TB meningitis treat for 9-12 mos.
Herpes virus encephalitis	Herpes virus	Acyclovir 10 mg/kg q 8h	Dose same as for adult	Treat for 2-3 weeks.
Brain Abscess	Aerobic and anaerobic Gm pos rods, prob. Strep sp Nocardia	Ceftriaxone 2 gm q 12h IV TMP/SMX 5-6 mg/kg q 6h IV		Identify source of Abscess. Drain abscess and identify microorganism.

*Penicillin Resistant Strep Pneumoniae (PRSP) has not been frequently reported from Pakistan (1st National Task Force Meeting for Antimicrobial Resistance (AMR)

Respiratory Tract Infections

Likely pathogens: S. pneumoniae, H.influenzae, M. catarrhalis, Chlamydia, Mycoplasma, Legionella

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Acute otitis media and acute mastoiditis	Amoxi/Clav 1.0 g po q12h or Cefuroxime 250 mg po q12h	Clarithromycin 500 mg po q12 (especially PCN-allergic pts)	Amoxicillin 20-50 mg/kg/day or Amox/Clav 20-45mg/kg/day q 8-12h. May use upto 80-90mg/kg	Treat 7-10 days. Add decongestant for symptomatic relief. Surgical drainage if abscess in mastoid bone.
Nosocomial Sinusitis	Pip/Tazo 4.5 g q8h + Amikacin 15mg/kg od			-Nasogastric tubes increase risk of nosocomial sinusitis. Removing tubes will improve drainage. -May require diagnostic aspiration. -If MRSA a consideration, add Vancomycin.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Chronic otitis media	Neomycin / Polymyxin Hydrocortisone Otic drops	Chloramphenicol Otic drops		Myringotomy for persistent effusion.
Malignant otitis externa	Ceftazidime 2 g 8h + Vancomycin 1-2 g q 12h	Imipenem 0.5 gm IV q 6h or Meropenem 1.0 gm IV q 8h or Cefepime 2.0 gm IV q12h		-For outpatient therapy in early disease: Ciprofloxacin 750 mg po q12h. If MRSA Linezolid po 600 mg bd. -Treat for 4-8 wks, if osteomyelitis present. Therapy may be changed acc. to isolate. Strict diabetes control advised.
Otomycosis	Boric acid or Acetic acid drops	Cresylate acetic otic drops	Boric acid or Acetic acid drops	
Acute Exacerbation of Chronic bronchitis (AECB)	Amoxicillin 500 mg tds or Amoxi/Clav 625 mg tds	Respiratory fluoroquinolone or macrolide		Treat for several weeks or throughout winter. Pneumococcal and influenza vaccines strongly recommended.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Acute sinusitis	Amoxicillin 500 mg tds, or Amoxi/Clav 625 mg tds	Levofloxacin 500 mg po qd or Cefuroxime 250 mg bid		Treat 5-7 d.
Chronic sinusitis	Amoxicillin 500 mg tds or Amoxi/Clav 625 mg tds	Clindamycin 300 mg q 8h or Azithromycin 500mg od x 3 days		Surgical drainage if fluid present.
Group A Strep Pharyngitis	Benz.penicillin LA 1.2 m U IM single dose or Erythromycin 250 mg qid po x 10 days	Cefuroxime 250 mg bd po x 5-10 days or Azithromycin 500 mg od x 5 days	B.PCN-LA 300,000-1.2 million units/kg or PCN-V25-50 mg/ kg/day q 8h or Erythromycin30-50 mg/kg/day q 8h po x10 days	Clinically screen for presence of the 4 Centor criteria: fever, tonsil exudates, no cough and tender lymph nodes. Only treat those with 3 or more criteria.
Epiglottitis	Cefuroxime 100-150 mg/d IV		Same as for adult	Provide airway.
Community acquired Pneumonia Out patient and no co-morbids	Clarithromycin 500 mg od or Azithromycin 500mg once then	Amoxi/Clav 1g po tds or Doxycycline 100 po mg bd	Amoxicillin 80-90 mg/kg/day or Cefuroxime 200-240 mg/kg/d q 8h IV or	Treat for 7-10 days.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
	250mg od or Levofloxacin 500 mg od or Moxifloxacin 400mg od		Amox-Clav 80-90 mg/kg/d q 8-12h or Azithromycin10mg/kg /day on day1& 5mg /kg/day po x 4days	
Community acquired Pneumonia Inpatients (COPD, diabetes, renal or congestive heart failure, or malignancy)	Ceftriaxone 2.0 gm IV od + Clarithromycin or Azithromycin (Dose as above)	Levofloxacin 500 mg od or Moxifloxacin 400mg od		Modify antibiotics to culture results.
Aspiration Pneumonia	Clindamycin 600 mg IV q 8h	Amoxi/Clav 1.2 g q 8h IV	Clindamycin 10-40 mg/kg/day IV q 8h	Rule out bronchial obstruction in patients not responding to therapy.
Lung abscess	Amox/clav 1g IV 8h or Clindamycin 600 mg IV q 8h			Surgical drainage may be required.

Intra-abdominal Infections

Likely pathogens: *E.coli*, *Enterobacter, enterococcus*, anaerobes, esp. *B. Fragilis*

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Amebic liver abscess Outpatient	Metronidazole 600mg po q 8h		Metronidazole 30 mg/kg/day q 8h	Treat 7-14 days or longer.
Amebic liver abscess Severe, large abscess	Metronidazole 500-750 mg IV q 8h		Metronidazole 500-750 mg IV q 8h	May require ultrasound guided drainage.
Pyogenic liver abscess	Ceftriaxone 1g bd IV + Metronidazole 500-750 mg IV q 8h	Amox/clav 1g po q 8h		Treat 2-3 wks.
Acute Cholecystitis	Ampicillin 2g IV q 6h + Gentamicin 1.2 g q 8h	Pip/Tazo 4.5g q 8h + Amikacin 15 mg/kg IV od		Surgical Consult.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Diverticulitis Out patient	Amox/clav 1.2 g q 8h po	Ciprofloxacin 500 mg bd po + Metronidazole 500 mg tds		
Peritonitis Mild to moderate	Pip/Tazo 4.5 g IV q 8h or Imipenem 500mg q 6h or Meropenem 1g q 8h or Tigecycline 100mg stat, then 50 mg q 12h IV	Ciprofloxacin 400 mg IV q 12h + Metronidazole 400 - 500 mg IV q 6h		Urgent Surgical Consult.
Peritonitis Severe	Ceftriaxone 1g q 12h + Amikacin 15mg/kg IV od			

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Gastroenteritis	None (Usually viral or toxin and self limited. Avoid antibiotics and Rehydrate)	Consider Ciprofloxacin 500 mg q 12h if prolonged symptoms or bacteremia.		Consider C.difficille if antibiotic use prior to diarrhea. If severe bloody diarrhea consider E.coli O157:H7 and risk of HUS. For diarrhea in HIV positive patients, consult ID.
Amebic dysentery	Metronidazole 400-600 mg po q 8h x 7-10 d If severe, Metronidazole 500mg IV q 8h, followed by Diloxanide Furoate 500mg tds x 7 d	Secnidazole 1-2 g po x 1	Same combination	Oral and intravenous Metronidazole have the same bioavailability. Step down to oral when clinically better.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Giardiasis	Metronidazole 200 mg po q 8h x 3-5 d	Secnidazole 1g po x 1	Metronidazole 15 mg/kg/day po q 8h	
H pylori	Omeprazole 20 mg bd + Amoxicillin 500 mg tds + Metronidazole 400 mg bd	Omeprazole 20 mg bd + Amoxicillin 500 mg tds + Clarithromycin 500 mg bd	Omeprazole 0.6-0.7 mg/kg day + Metronidazole 15 mg/kg/day po q 8h	Treat for 2 weeks.
C. difficile colitis	Metronidazole 400 mg po q 8h	Vanco 125 mg q 6h po (from vial)	Metronidazole 15 mg/kg day	
Cholera	Hydration most important	Single dose Ciproflox 1g po		

Urinary Tract Infection

Likely pathogens: E.coli, enterococcus, Enterbacteriaceae, S. saprophyticus
Indwelling catheter: Pseudomonas, Klebsiella, enterococci, acinetobacter, candida

Clean catch mid stream urine culture essential prior to start of antibiotics. Except for acute uncomplicated UTI there are high chances of ESBL gram negative bacilli

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Acute Uncomplicated cystitis	Ciprofloxacin 500 mg po bd	Fosfomycin 3 g x 1 po or Amoxi/Clav 625mg tds or Cefixime 400 mg od	Cefixime 10 mg/kg If severe infection Amikacin, 15 mg per kg od x 1	Treat for 3 days. Culture not required.
Acute uncomplicated pyelonephritis	Ciprofloxacin 400mg IV q 12h	Ceftriaxone 1g bd + Amikacin 15mg/kg od or Imipenem 500 mg q 6h or Meropenem 500 mg q 8h	Ampicillin 100 mg/kg/day q 8h or Ceftriaxone 50-75 mg/kg/day + Gentamicin 3-5 mg/kg/day q 8 h	Urine culture essential prior to antibiotics. Change antibiotics accordingly.
UTI in males	Ciprofloxacin 500 mg po bd 5-10 d			Investigate for anatomic abnormality, prostatitis.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Nosocomial (or indwelling Foley)	Pip/Tazo 4.5gm IV q 8h or Ciprofloxacin 400mg IV q 12h or Ofloxacin 400 mg IV q 12h	Amikacin 15 mg/kg IV od		Treat for 2-3 weeks Remove Foley catheter if possible. Modify antibiotics after culture result. No proven benefit of flushing catheter as infection travels from outside of cath, not through lumen. May introduce infection.
Asymptomatic Bacteriuria	Antibiotics as in acute uncomplicated cystitis	Cephalosporin		No treatment unless preceding a surgical intervention or pregnant. Culture urine.
Prostatitis	TMP/SMX 2 DS bd or Ciprofloxacin 500 mg po bd	Ceftriaxone 1-2 g IV q 24h		Treat for 2-3 weeks.Change antibiotic based on culture results.
Sterile pyuria				Investigate for renal TB.

Skin, Soft Tissue and Bone

Likely pathogens; *S aureus* (MSSA or MRSA)

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Osteomyelitis MSSA	Cefazolin 1g IV q 8h		Cefazolin 100-150 mg/kg/day q 8h IV or Nafcillin 150-200 mg/kg/day q 6h	Treat for 4-6 wks. Bone biopsy with cultures very helpful in directing therapy.
Osteomyelitis MRSA	Vancomycin1g q 12h IV or Teicoplanin 400mg IV q 12h for 3 doses then 400mg q 24h or Linezolid 600mg po q 12h		Vancomycin 40 mg/kg/day q 6h IV	Keep Vancomycin trough levels 10µg/ml-15µg/ml. Prolonged Linezolid use may cause bone marrow suppression.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Osteomyelitis Polymicrobial	Ciprofloxacin 750 mg po q 12h + Clindamycin 300-600 mg q 8h	Imipenem 500mg q 6 h or Meropenem 1g q 8h		
Recurrent boils, Hydradenitis suppurativa	Cloxacillin 250 – 500 mg qid po	Amoxi/Clav 625mg tds MRSA: Linezolid 600 mg bid po	Cloxacillin 250-500 mg/kg/day q 6h po	Treat 5-7 days, 2 wks for hidradenitis suppurativa. Surgery may be required.
Cellulitis	Cloxacillin IV then po	Clindamycin 300-600 mg q 8h.		Elevate leg, warm compresses.
Diabetic ulcer/cellulitis Staph. aureus, Strep. Sp., Gram-negative bacilli, Anaerobes May be polymicrobial	Amoxicillin/Clav1 g po/1.2 gm IV q 12h or Ciprofloxacin 500 mg po/IV q 12h + Clindamycin 600 mg po/IV q 8h	(If life/limb-threatening infection: Imipenem 500 mg IV q 6h or Meropenem I gm IV q 8h + Vancomycin 1.0 gm IV q 12h		-Elevate extremity. -Cultures from ulcers unreliable. -Consider osteomyelitis in chronic/recurrent ulcers. -Surgical consultation should be obtained.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Necrotizing fasciitis	Pen G 24 million units/day IV divided q 4-6h + Clindamycin600-900 mg IV q 8h or Imipenem 500 mg IV q 6h or Meropenem 1gm IV q 8h	Tigecycline IV 100 mg stat, then 50 mg 12h	Pen G 25,000-50,000 units/kg/day + Clindamycin 10-40 mg/kg/day q 6-8h IV + Aminoglycoside 3-5 mg/kg/day q 8h	May be life threatening. Surgical debridement essential.
Monoarticular septic arthritis S.aureus Streptococci N gonorrhea G – ve Bacilli	Cefazolin 1 g q 6h or Cefotaxime 1g IV q 8h	Clindamycin 600 mg q 6h IV or Ciprofloxacin 400 mg q 12h IV or Cefixime 400 mg po bid	Cefazolin 100-150 mg/kg/day q 6h or Nafcillin 150-200 mg/kg/day q 6h	Joint fluid should be drained adequately and cultured. If gonococcus suspected, culture urethra, cervix, throat and blood in addition to joint fluid. Treat x 14-28 days.
Prosthetic joint or post surgical consider MRSA	Vancomycin 1.0 gm IV q 12h + Ciprofloxacin 750mg po q 12h +/- Rifampin 900 mg po qd	If renal dysfunction use IV Teicoplanin or Linezolid	Vancomycin 40 mg/kg/day q 6h IV or Clindamycin 40mg/kg/day q 8h	May require removal of prosthesis. Treat for 6 weeks or longer.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Animal bites	Amoxi/Clav 375 mg tds po	Cefuroxime 250 mg bd po + Metronidazole 400 mg tds, or Clindamycin 600 mg tds		5 days. For possible rabies bite, anti rabies vaccine and immunoglobulin reqd.
Burns	Aminoglycoside + Antipseudomonal PCN or Cephalosporin	Vancomycin if S. aureus suspected.		Topical silver – Sulfadiazine
Diabetic foot ulcer & Decubitus ulcers (Usually polymicrobial)	For severe infection Carbapenem + Vanco For moderately severe infection oral Cephalexin 500 mg qid +/- Clindamycin 600 mg tds, or Amoxi/Clav 375 mg tds po or Cefepime 400 mg bd, or Moxifloxacin. 400 mg od	In severe cases Tigecycline IV 100 mg stat, then 50 mg 12h		Final regimen based on gm stain & culture. Length of Tx depending on presence of osteomyelitis, clinical response.

Sexually Transmitted Diseases

Disease	Preferred Antibiotics	Alternative	Comments
Pelvic inflammatory disease	eftriaxone 1 g q 12h + Metronidazole 500 mg q 8h IV + Doxycycline 100 mg q 12h IV	Carbapenem	Avoid tetracycline in pregnancy. Treat 8-10 d.
Gonococcal Urethritis	Cipro 500 mg po x 1 or Cefixime 400 mg po x 1 or Ceftriaxone 125 mg IM x 1	Azithromycin 1g po x 1	Treat for both Gonorrhea & Chlamydia.
Disseminated gonococcal infection	Ceftriaxone 1g IM or IV od + Doxycycline 200 po bd	Cefixime 400mg po bd or Cipro 500 bd + Doxy 200 bd	Treat for 1 week.
Vaginitis (Candidal)	Fluconazole 150 mg x1 or Clotrimazole vaginal tabs 500 mg x 1	Clotrimazole Cream	

Disease	Preferred Antibiotics	Alternative	Comments
Trichomoniasis	Metronidazole 500mg po q 12h		For 5-7 d.
Bacterial vaginosis	Metronidazole 400mg 5tab po x 1		
Chlamydia	Doxycycline 100mg bd po x 7 d	Erythromycin 500 mg qid x 7 d	
Syphilis primary,secondary or early latent (<1 yr) Late latent (> 1 yr) VDRL, FTA reactive	Benzyl PCN 2.4 m U IM x 1 Benzathine PCN (LA) 2.4 mill U IM weekly x 3	Doxycycline 100 mg po bd x 5 days or Azithromycin 500 mg po x1	High rates of treatment failure with Doxycycline. ID consultation required for neurosyphilis. Treat spouse as well. VDRL and FTA may/ may not become neg after treatment.
Primary genital herpes	Acyclovir 400 mg x 5 / day po x 10 days	Valacyclovir 1g po bd x 5 days	Shortens duration of pain, viral shedding. Treat spouse as well.
Recurrent genital herpes	Acyclovir 400 mg po x 3 days	Valacyclovir 500 mg po bd x 5 days	Effective if started early pref<24 hours. Antiviral use in pregnancy is controversial. Consult ID expert.

Sepsis

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Life threatening sepsis*	Amikacin 15 mg/kg q 24h + Carbapenem	Aminoglycoside + Pip-tazobactam or 3rd generation Cephalosporin		For suspected S.aureus add IV Vanc 1g q 12h. If fungal infection suspected, Amphotericin 0.7mg/kg/day or Fluconazole 400 mg stat then 200 mg od IV. Fluid resuscitation essential.
Neutropenia	Carbapenem or Cefepime or Ceftazidime or Pip-tazobactam +/- Aminoglycoside	Fluconazole or Amphoterecin if fungal infection suspected		
Urosepsis	Carbapenem, or 3rd generation Cephalosporin or Pip-tazobactam +/- Aminoglycoside			Remove indwelling cath.
Enteric fever	Ceftriaxone 1 gm bd IV De-escalate to Cefixime 400 mg po od	Quinolone resistance is rising	Amoxicillin 75-100mg/kg/day q 8h x14 days Cefixime 15-20mg/kg/day x 7-14 days	Blood Cx essential prior to start Abx.Treat 7-14 d. Serologic tests not always helpful. May switch to less expensive abx if culture indicates.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Biliary tract source	Piptazobactam or Amp-sulbactam + Aminoglycoside	Piperacillin + Metronidazole +/- Aminoglycoside		
Endocarditis (cultures pending) Native valve	Ampicillin IV 2gm q 4h + Gentamicin IV 1.7 mg /kg q 8h	Ceftriaxone 2 g IV od + Gentamicin 1 mg/kg q 8h IV for 2 weeks or Cefazolin 2 g q 6h + Gentamicin	Pen G 200,000 U/kg/ day q 4-6h IV or Ceftriaxone 2g/day IV in one dose + Gentamicin3mg/kg/ dayIV in 1-3 doses	Send at least 3 sets of blood cultures In 1st 24 hours. - Modify regimen when blood cultures positive. -Treat for 4 weeks.
Prosthetic valve	Vancomycin 15mg/kg IV q12h + Gentamicin 1mg/kg IV q 8h + Rifampin 600 mg po qd			Surgical consultation should be taken.
IV line sepsis	Augmentin 1gm q 8h IV or 3rd gen. Cephalosporin	If febrile neutropenia, Vancomycin 500 -1 gm q 12h IV		Remove IV line. No abx if no clinical sepsis.

*Bedside diagnosis: Hyper or hypothermia, tachycardia, tachypnea, mental confusion, leukocytosis or leukopenia, thrombocytopenia.
Pan culture before starting Abx

Malaria

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Acute P. Vivax	Chloroquine phosphate 1 gm stat, 500 mgm, after 6h, 500 mg/day x 2 days (10 tab)	Pyrimethamine/ Sulfamethoxazole 3 tab x 1 Artemether/ Lumefantrene 20/120 4 tab stat, 4 after 8, 24, 48h (16 tab) or Artemether / Lumefantrene 40/240 2 stat, 2 after 8,24, 48h (8 tab)	10 mg/kg stat, 5 mg/kg after 6h, and daily x 2 days <1 yr: ¼ tab 1-3 yr ½ tab 4-8 yr 1 tab 9-14 yr 2 tab 5-15 kg: 1 tab stat, 1after 8, 24, 48h	Chloroquine safe in pregnancy, children. Caution: Rash, Steven Johnson Syndrome, bone marrow depression with sulfa not uncommon.
Radical Cure of P. Vivax	Primaquine Adult dose: 15 mg daily x 14 days		0.3 mg/kg daily x 14 days	Relapse rate in the subcontinent is approx 20%.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
				Hemolysis if G6PD deficient. Check G6PD prior to therapy. If not deficient use primaquine. If deficient try Chloroquine 250 mg od indefintely.
P.falciparum (uncomplicated)	Artemether/ Lumefantrene 20/120 4 tab stat, 4 after 8, 24, 48h (16 tab) or Artemether / Lumefantrene 40/240 2 stat, 2 after 8,24, 48h (8 tab)	Artemether 80 mg bd for the first day and then 40 mg bd for days 2 to 5 + Doxycycline Dose: 100 mg bd po x 7 days	Artemether/ Lumefantrene 20/120 5-15 kg: 1 tab stat, and after 8, 24, 48h 15-25 kg: 2 stat, 2 after 8, 24, 48h	DO NOT use monotherapy for P.falciparum.
P. Falciparum (complicated)	Artemether Adult Dose: Loading dose 160 mg IM, then	QuinineSulphate Adult Dose: 20 mg/kg loading dose, then 10 mg/kg 500 ml D5/w	Artemether Loading dose: 3.2 mg/kg, IM then 1.6 mg/kg IM daily x 5 days	Parenteral therapy indicated if cannot tolerate orally.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
	80 mg IM daily x 5 days + Doxycycline Dose: 100 mg bd po x 7 days	over 4h, then 10mg/kg in D5/W over 2-4h, q 8h x 3-7 days until able to take oral therapy + Doxycycline Dose: 100 mg bd x 7 days	Quinine Sulphate 25 mg/kg q 8h x 3 – 7 days	Artemether generally safe, but may not be absorbed IM in shock. Quinine preferred in shock. Quinine: Adverse effects: Cinchonism,tinnitus, thrombocytopenia, hypoglycemia. Abortion in pregnancy, but may be life saving for mother.
Malaria prophylaxis for the traveler (usual requested by persons traveling to Pk)	Chloroquine phosphate (for P. vivax) 500 mg per week Doxycycline 100 mg/day + Proguanil 200 mg/day	Mefloquine tab 250 mg/week	Chloroquine : 5 mg/kg/week Proguanil 2-6y: 100 mg 7-10y: 150 mg	Start 2 weeks prior to travel, throughout stay in malarious area, and for 4 weeks after leaving. Mefloquine and Proguanil not available in Pakistan. Travelers should bring own supply.

Helminthiasis

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Ascariasis (Roundworm), Ankylostoma duodenale (Hookworm), Trichiuriasis (Whipworm)	Albendazole 400 mg x 1	Mebendazole 100 mg bd x 3d, or 400 mg x 1	Same dose as adult	Dose may be repeated q 2 weekly. Pediatric Dose: Same as adult.
Enterobius vermicularis (pinworm)	Albendazole 400 mg x 1, repeat in 2 weeks	Mebendazole 100 mg x 1, repeat in 2 wks		Pediatric Dose: Same as adult.
Echinococcus granulosis (Hydatid cyst)	Albendazole Adult Dose: 400 mg bd x 28 d, hold 2 wks, repeat 2-4 cycles as necessary		Albendazole 15 mg/kg/day q 12h po for 1-6 months	Rx for Hydatid not always successful Surgical intervention if pressure signs.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Filariasis Wuchereria Bancrofti	Diethylcarbamazine (Hetrazan®) po Day 1: 50 mg Day 2: 50 mg q 8 h Day 3: 100 mg q 8 h Days 4-14: 2 mg /kg q 8h	Ivermectin 400 mcg/kg pox1 + Albendazole 400 m g po x1		Antihistamine/steroid if reaction from dying parasites.
Leishmaniasias	Sodium Stibogluconate Adult Dose: 20 mg/kg/d IV or IM x 20-28 d Pentamidine isethionate Adult Dose: 2-4 mg/kg/d x 15 doses	Amphoterecin B Adult Dose: 1 mg/kg/day x 8 wks Fluconazole 200 mg od po x 8 wks	Same as adult	Fever, phlebitis, Hypokalemia, nephrotoxicity. Cutaneous leishmaniasis may occasionally be self limiting.

Viral, Fungal and Others

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Herpes Gingivo- stomatitis	Acyclovir 400mg x 5/day x 7- 14 days.		Acyclovir 15-30 mg/kg/day in 5 doses /day	
Herpes labialis	Acyclovir cream			
Varicella-Zoster Immunocompetent Immunocompromised	Acyclovir 800 mg x 5/day x 5 days. Acyclovir 10 mg/kg IV q 8h x 8-10 days.	Famcyclovir 500 mg tds po x 5-7 d or Valacyclovir 1 gm bd x 5-7 d		Must Tx within 24h of appearance of rash Topical antiviral not effective.
Scabies	Permethrin lotion x 3 days	Benzyl benzoate lotion		Apply to body below neck at night and wash in am. Wash all bed clothes and apparel in boiling water. Treat other family members.

Disease	Preferred Antibiotics	Alternative	Pediatric Dose	Comments
Tinea pedis, corporis,cruria	Clotrimazole or Ketoconazole cream. Apply bd for 2-4 wks	Fluconazole 150mg x wkly for 2 to 4 wks		
Ringworm (Tinea capitis)	Terbinafine 250 mg po od x 3 wks			
Onychomycosis	Terbinafine 250 mg po od x 6 wks	Itraconazole 200 mg od po x 3 mos		Success rate 76%.

Treatment of Tuberculosis with First Line Drugs

Treatment of TB is a commitment and responsibility on the part of the treating physician. Patient adherence is paramount, as default, inadequate dose or length of treatment is a recipe for development of drug resistance. Monitoring of side effects and confidence building between patient and doctor are key to successful outcome.

Category 1: (Never been treated in the past)

- National TB Program (NTP) recommends 6 months HE in continuation phase (Option 1)
- IUTLD recommends 4 months HR in continuation hase (Option 2)

Category 2: (Retreatment after failure or relapse)

Abbreviations:

INH (H), Rifampicin (R), Ethambutal (E), Pyrazinamide (Z) Streptomycin (S), Intensive Phase (IP), Continuation Phase (CP)

Dose in renal insufficiency (Cr Cl < 30 ml/min, or on hemodialysis:

- INH: no change
- Rifampicin: no change
- Ethambutal: 15-25 mg/kg 3 times /wk (not daily)
- Pyrazinamide: 25-35 mg/kg 3 times /wk (not daily)

Category 1 (Option 1 - NTP)

Body Weight in Kg	IP (2 mos)	CP (6 mos)
30-39	H 200, R300, E 600, Z 800	H 225, E 600
40-54	H 300, R 450, E 800, Z 1200	H 300, E 800
55-70	H 300, R 600, E 1200, Z 1500	H 300, E 1200
> 70	H 300, R 600, E 1400, Z 2000	H 300, E 1400

Category 1 (Option 2 - IUTLD)

Body Weight in Kg	IP (2 mos)	CP (4 mos)
30-39	H 200, R300, E 600, Z 800	H 225, R 300
40-54	H 300, R 450, E 800, Z 1200	H 300, R 450
55-70	H 300, R 600, E 1200, Z 1500	H 300, R 600
> 70	H 300, R 600, E 1400, Z 2000	H 300, R 600

Category 2

Body Weight in Kg	IP		CP
	HREZ (3 mos)	S (2 mos)	HRE (5 mos)
30-39	H 200, R300, E 600, Z 800	500	H 225, R 300, E 600
40-54	H 300, R 450, E 800, Z 1200	750	H 300, R 450, E 800
55-70	H 300, R 600, E 1200, Z 1500	750	H 300, R 600, E 1200
> 70	H 300, R 600, E 1400, Z 2000	750	H 300, R 600, E 1400

All drugs are in mg.

Antibiotics Use in Pregnancy:

Those considered safe:

- Penicillin and penicillin derivatives, including Amoxicillin/Clavulanic Acid,
- All generations of Cephalosporins
- Clindamycin

Those that may be used after careful consideration of risk/benefit:

- Carbapenams
- Metronidazole
- Quinolones
- Aminoglycosides (may cause decreased hearing in the newborn)
- Vancomycin

1st line Anti TB drugs may be used during pregnancy as TB is considered a serious disease

2nd line ATT may be used during pregnancy only after consultation with ID expert

Antimicrobial Penetration into Cerebrospinal Fluid

Without meningeal inflammation	With meningeal inflammation	Sub therapeutic concentration
Chloramphenicol Metronidazole Sulfonamides INH Rifampicin	Penicillin G in high dose Ampicillin 2nd gen Cephalosporins 3rd gen cephalosporins Carbapenams Pip/tazo Vancomycin Acyclovir Ciprofloxacin	Aminoglycosides 1st gen cephalosporins Clindamycin Itraconazole Polymyxin Amphotericin

Surgical Prophylaxis

Prophylactic antibiotics are given with the expectation of *prevention* of infection, and NOT as treatment of existing infection. Hence, prophylaxis must be given in anticipation of microorganisms that are likely to cause infection

- Pre –op indicates administration **while inducting anesthesia** so that maximum level of antibiotic is achieved at the time the incision is made. More than a single pre- operative dose is discouraged; however if the procedure is > 2 hrs, additional dose may be given
- Intra –op is given for **long procedures** and may be repeated in 2-4 h
- Vancomycin may be given when the rate of wound infection with MRSA or MRSE is high in a given hospital
- There is no substitute for good sterilization and Infection Control practices

GI Surgery

Gastric Surgery	Cefazolin 1-2 g IV single dose, or continue for 1-2 d
Biliary tract	Cefazolin 1-2 g IV pre op Alt. Amoxi-Clav 1.2 g pre-op and q 8h x 3; or Gentamicin 1.7 mg/kg pre –op and q 8h
Colorectal	Bowel prep + Cefazolin 1-2 g IV + Gentamicin 1.5 mg/kg pre-op and q 8h x 3 doses + Metronidazole
Penetrating abd trauma	Same as above
Appendectomy	Same as above. If perforation or gangrenous, continue for 5 days

Head & Neck and ENT Procedures

Tonsillectomy/ adenoidectomy	None
Rhinoplasty	None
Major surgery via oral cavity or pharynx	Cefazolin 1-2 g IV pre op and q 8h x 2 doses or Clindamycin 600 mg IV + Gentamicin 1.7 mg/kg pre –op and q 8h x 24 h

Orthopedic Surgery

Clean, not involving prosthesis	None
Joint replacement	Cefazolin 1-2 g IV pre-op or Vancomycin 1g IV
Open Reduction of fractures	Cefazolin 2 gm IV pre-op or Vancomycin 1 g IV pre-op
Compound fracture	Cefazolin 1-2 g IV pre-op and q 8h x 5-10 d or Clindamycin 600 mg q 8h
Amputation of leg	Cefazolin 1g IV pre-op or Amoxi-Clav 1.2 g pre-op

Cardiac Surgery

Cefazolin 1-2 g IV or Vancomycin 1 g IV pre op, run over 1 hr, and continue q 12h until all tubes are removed in 1-2 days.
Consider intranasal mupiricin 2 days pre op and for 5 d post op

Gynecologic Surgery

Uncomplicated Caesarian section, D & C	No prophylaxis
Complicated, hysterectomy, oophorectomy, cystocele, rectocele repair	Pre op Cefazolin 1-2 g IV or Clindamycin 600 mg IV or Metronidazole 500 mg IV

Urologic Surgery

Antibiotic not indicated if sterile urine. If pre op bacteriuria, treat first. Recommended 1st gen cephalosporin 1-3 doses periop, then po Cotrimoxazole for 10 d or till catheter removed.

Transrectal Prostate Biopsy	Ciprofloxacin 500 mg po 12h prior to biopsy, then repeat 12h after first dose

Antibiotic Groups

Penicillins:
Penicillin G (Benzyl);
Benzathine penicillin (long acting)
Ampicillin
Amoxicillin
Cloxacillin
Amoxicillin/Clavulanate
Pipericillin/Tazobactam

Aminoglycosides:
Streptomycin
Gentamicin
Tobramycin
Amikacin

Cephalosporins:

1st Gen: Cefazolin
Cephradine (Oral and parenteral)

2nd Gen: Cefaclor (Oral)
Cefuroxime (Oral and parenteral)

3rd Gen: Ceftazidime
Ceftriaxone
Cefotaxime
Cefixime (Oral)
Cefoperazone

4th Gen: Cefepime
Cefpirome

Carbapenems:
Imipenem
Meropenem
Ertapenem

Fluoroquinolones:
Ciprofloxacin
Norfloxacin
Ofloxacin
Levofloxacin
Moxifloxacin
Gatifloxacin
Sparfloxacin
Lomefloxacin

Macrolids:
Erythromycin
Clarithromycin
Azithromycin

Glycopeptides	Vancomycin Daptomycin
Glycylcycline	Tigecycline
Tetracycline:	Doxycyline
Miscellaneous:	Metronidazole Aztreonam Chloramphenicol

Antibiotics for Specific Infections

Methicillin Sensitive S. aureus (MSSA):	Cloxacillin Cephradine Amoxicillin/Clavulanate
Methicillin Resistant S. aureus (MRSA):	Fusidic acid Vancomycin Teicoplanin Linezolid Tigecycline
Antipseudomonas:	Ceftazidime Amikacin Imipenem Meropenem Ciprofloxacin
Anti Tuberculosis:	**1st line:** Isoniazid Rifampicin Ethambutal Pyrazinamide Streptomycin **2nd line:** Amikacin Kanamycin Capreomycin Quinolones Ethionamide Cycloserine Paraaminosalicylic acid (PAS)
Drugs used against leprosy:	Clofazamine Rifampicin Dapsone
Drugs used against Hepatitis B:	Lamivudine Adefovir dipivoxil

	Entecavir Telbivudine Tenofovir
Drugs used against Hepatitis C:	Alpha Interferon Pegylated Interferon alfa-2a (Pegasys) Pegylated Interferon alfa-2b (Peg-Intron) Ribavirin

Special Notes

Tigecycline:	effective against all aerobic and anaerobic gram pos and gram neg cocci and bacilli (except pseudomonas), including VRSA, VRE, Acinetobacter. Proven efficacy in intraabdominal and complicated soft tissue infections. Twice a day dosage IV. Good clinical and side effect profile.
Linezolid:	effective against nearly all antibiotic resistant gram pos cocci, including MRSA and VRE. Twice a day dosage po or IV. Good clinical and side effect profile.
Teicoplanin:	Good alternative to Vancomycin in renal insufficiency.
Ertapenem:	Carbapenam, not effective against pseudomonas. Advantage: od dosage.
For MSSA infections:	Cloxacillin group is more effective than glycopeptides.
Meropenem usual dose:	500 mg q 8h IV
Imipenem dosage:	UTI 500 mg q 6h, moderate infection 500 mg q 6-8h, severe infection (sepsis) 1 gm q 6-8h.

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- Principles of Judicious Use of Antimicrobial Agents for Pediatric Upper Respiratory Tract Infections. Dowell SF, Marcy SM, Phillips WR, Gerber MA, Schwartz, B. Pediatrics. 1998; 101:163 -165.
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Renal Dose Adjustment

Calculation of Creatinine Clearance:

For males: $\frac{140 \times \text{age} \times \text{Wt in kg}}{72 \times \text{S. Creatinine}}$ For females: $\frac{(140 \times \text{age} \times \text{Wt in kg}) \times 0.85}{72 \times \text{S. Creatinine}}$

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Acyclovir	HSV immuno-compromised	5 mg/kg q 8h IV x7d	25-50 5mg/kg q 12h	10-25 5mg/kg q 24h	0-10 2.5 mg/kg q 24h	2.5 mg/kg q 24h		
	HSV encephalitis	10 mg/kg q 8h IV x10d	25-50 10mg/kg q 12h	10-25 10mg/kg q 24h	0-10 5 mg/kg q 24h	5 mg/kg q 24h		
	VZV immuno-compromised	10 mg/kg q 8h IV x7d	25-50 10mg/kg q 12h	10-25 10mg/kg q 24h	0-10 5 mg/kg q 24h	5 mg/kg q 24h		
	Genital HSV (initial)	200mg q 4h 5x/d x10d			0-10 200mg q 12h	200mg q 12h		
	VZV	800mg q 4h 5x/d x7d		10-25 800mg q 8h	0-10 800mg q 12h	800mg q 12h		

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Amikacin	Multiple Daily Dosing	15 mg/kg/d divided q 12h	>50 9-13.5 mg/kg/d divided q 12h	10-50 4.5-10.5 mg/ kg/d, divided q 12-18h	<10 3-4.5 mg/kg q 24-48h	3-4.5 mg/kg q 24-48h	11.25 mg/kg	
	UTI	250mg q 12h						
	Once Daily Dosing	15mg/kg q 24h	Not recommended					
Amoxicillin / clavulanate	375 mg (250/125)	1 tablet 3x daily		10-30 1 tab 2x daily	<10 1 tab q 24h	1 tab q 24h	Extra dose	1 tab q 12h
	625 mg (500/125)	1 tablet 2x daily		10-30 1 tab 2x daily	<10 1 tab q 24h	1 tab q 24h	Extra dose	1 tab q 12h
	625 mg (500/125)	1 tablet 3x daily		10-30 1 tab 2x daily	<10 1 tab q 24h	1 tab q 24h	Extra dose	1 tab q 12h
	1 g PO	1 tablet 2x daily		375mg or 625 mg 2x daily	325 mg q 24h	325 mg q 24h	-	
	1g iv	1 g iv q 8h	1 g iv q 8h	10-30 1 g ivx1 then 600mg q 12h	<10 1g ivx1 then 600 mg q 24h	1g ivx1 then 600 mg q 24h	600 mg	

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Amphotericin B	Systemic fungal Infection	0.25-1.0 mg/kg q 24h			<10 0.25-1.0 mg/kg q 24-36h	0.25-1.0 mg/kg q 24h-36h	-	
Artemether	IM/PO	Day 1: 80mg BD then 80mg OD or 40mg BD x5-7 days						
Artemether / lumefantine	Exafal	4 tabs stat then 8, 24, 36, 48, 60 hours later						
	ArtemDS Plus	2 tabs stat then 8, 24, 36, 48, 60 hours later						
Azithromycin i/v	Community Acquired Pneumonia	500 mg q 24h			<10 (caution) 500 mg q 24h	(caution) 500 mg q 24h but caution	-	
Azithromycin po	Upper or Lower Respiratory Infection	500 mg x1 then 250 mg q 24h x4days			<10 (caution) 500 mg x1 then 250 mg q 24h	(caution) 500 mg x1 then 250 mg q 24h	-	
	COPD exacerbation, Sinusitis	500 mg q 24h x3days			<10 (caution) 500 mg q 24h	(caution) 500 mg q 24h		
	Typhoid	1gx1 then 500mg q 24h x6d			<10 (caution) 1gx1 then 500mg q 24h	(caution) 1gx1 then 500mg q24h	-	

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Aztreonam	Moderate infections, UTI	0.5mg -1 g q 8-12h	30-80 Load then 0.25-500 mg q 8-12h	10-29 Load then 150-300 mg q8-12h	<10 Load then125-250mg q8-12h	Load then 125-250 mg q 8-12h	125 mg	1g x1 then 500mg IP
			30-80 0.5-1g q 16-24h	10-29 0.5-1g q21-36h	<10 0.5-1g q 28-48h	0.5-1g q 28-48h		
	Severe Infections, meningitis	2 g q 6h	30-80 Load then 1g q 8-12h	10-29 Load then 600mg q 8-12h	<10 Load then 500mg q8-12h	Load then 500 mg q 8-12h	500mg	
			30-80 2g q 16-24h	10-29 2g q 21-36h	<10 2g q 28-48h	2g q 28-48h		
Cefepime	Mild to Mod UTI	500 mg q 12h	30-60 500mg q 12h	11-29 500 mg q 24h	<10 250 mg q 24h	1g once then 500mg q 24h	Give dose after HD	500 g q 48h
	Mild to Moderate Infection	1 g q 12h	30-60 1 g q 12h	11-29 500 mg q 24h	<10 250 mg q 24h	1 g once then 500mg q 24h	Give dose after HD	1 g q 48h
	Severe Infection/ pneumonia/ pyelonephritis	2 g q 12h	30-60 2 g q 24h	11-29 1 g q 24h	<10 500 mg q 24h	1 g once then 500g q 24h	Give dose after HD	2g q 48h

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
	Neutropenic fever	2 g q 8h	30-60 2 g q 12h	11-29 2 g q 24h	<10 1 g q 24h	1 g q 24h	Give dose after HD	2g q 48h
Cefotaxime	Mild infections	1 g q 12h		10-50 1 g q 12h	<10 1 g q 24h	1 g q 24h	1 g	1 g q 24h
	Moderate Infections	1-2g q 8h		10-50 1-2 g q 12h	<10 1-2 g q 24h	1-2 g q 24h	1 g	1 g q 24h
	Severe Infections	2 g q 6h		10-50 2 g q 12h	<10 2 g q 24h	2 g q 24h	1 g	1 g q 24h
Cefperazone /sulbactam	Mild to moderate infections	1.5 g q 12h	1.5 g q 12h	1.5 g q 12h	1.5 g q 12h	1.5 g q 12h	-	1.5 g q12h
	Moderate infections	3 g q 12h	3 g q 12h	3 g q 12h	3 g q 12h	3 g q 12h		3 g q 12h
	Severe Infections	6 g q 12h	6 g q 12h	-	-	-	-	

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Ceftazadime	Skin and soft tissue	1 g q 12h		10-50 1 g q 24h	<10 1 g q 48h	1g loading	1g	
	Uncomplicated UTI	250mg q12h		10-50 250mg q 24h	<10 250mg q 48h	1g loading	1g	
	Complicated UTI	500mg q 8-24h		10-50 500mg q 24h	10-50 500mg q 48h	1g loading	1g	
	Meningitis, severe infections, intrabdominal infections	2g q 8h		10-50 2g q 24h	10-50 2g q 48h	1g loading	1g	
	Surgical Prophylaxis	1 g ½ hr before surgery						
Cefazolin	Mild	250-500mg q 8h		11-34 125-250mg q12h	<10 125-250mg q 24h			
	Moderate to Severe	0.5-1g q 6-8h		11-34 250-500mg q12h	<10 250-500mg q 24h			

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
	Life Threatening/ Endocarditis	1-1.5g q 6h		11-34 0.5-1.25g q 12h	<10 0.5-1.25g q 24h			
		2g q 8h		11-34 1g q 12h	<10 1g q 24h			
Ceftriaxone	Endocarditis, febrile neutropenia	2g q 24h						
	Meningitis	2g q 12h						
	Sepsis	1q g 12h						
	Surgical prophylaxis	1 g ½ h before surgery						
Cefuroxime								
Chloramphe-nicol	Oral	25-50 mg/kg q 6h						
	i/v	12.5 mg/kg q 4h						

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Ciprofloxacin i/v	UTI	200mg q 12h	>50 200mg q 24h	10-50 200mg q 18h or 100-150 mg q 12h	<10 200mg q 24h or 100mg q 12h	200mg q 24h		
	Mild to moderate infections/ Intrabdominal Infections/ prostatits/ Complicated UTI	400 mg iv q 12h	>50 400 mg iv q 12h	10-50 400mg q 18h or 200-300 mg q 12h	<10 400mg q 24h or 200mg q 12h	400 mg iv q 24h		
	Severe Infections (except UTI)	400 mg iv q 8h	>60 400 mg iv q 8h	31-60 400 mg iv q 12h	<30 400 mg iv q 24h	400 mg iv q 24h		

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Ciprofloxacin PO	Mild to Moderate infections/ Typhoid/ Intra ab Infections/ Prostatitis/ Diarrhea	500 mg po q 12h	>50 500 mg po q 12h	30-50 500 mg po q 12h	5-29 500 mg po q 18h	500 mg po q 24h	Dose After HD	500 mg po q 24h
	Uncomplicated UTI	250 mg po q 12h	>50 250 mg po q 12h	30-50 250 mg po q 12h	5-29 250 mg PO q18h	250 mg po q 24h	Dose After HD	250 mg po q 24h
	Complicated UTI	500 mg po q 12h	>50 500mg po q 12h	30-50 250 mg po q 12h	5-29 250 mg PO q18h	250 mg po q 24h	Dose After HD	500 mg po q 24h
Clindamycin	Oral	150-450 mg q 6h						
	IV	900mg q 8h or 600mg q 6h						

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Cloxacillin	Mild infections	250 mg po q 6h						
	Moderate infections	500 mg po q 6h						
	Severe Infections	1-2 g iv q 6h						
	Endocarditis	2 g q 4h						
Ethambutol								
Fluconazole	Oropharyngeal Candidiasis	200 mg x1 then 100 mg q 24h x 2weeks		<50 200 mg x1 then 50 mg q 24h		200 mg x1 then 50 mg q 24h	50 mg	
	Systemic Candidiasis	400 mg q 24h x 4 weeks		<50 200 mg q 24h		then 200 mg q 24h	200 mg	
	Candida UTI	200 mg x1 then 100 mg q 24h x 4d		<50 200 mg x1 then 50 mg q 24h		200 mg x1 then 50 mg q 24h	50 mg	
	Cryptococcal Meningitis	400 mg x1 then 200 mg q 24h x10-12 wks after neg c/s		<50 400 mg x1 then 100 mg q 24h		400 mg x1 then 100 mg q 24h	100 mg	

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Fosfomycin	Oral	500mg to 1 g q 8h						
	IV	2-4 g q 6h						
Fusidic Acid	Skin and Soft Tissue Infections	500 mg q 8h x1-2 weeks						
	Osteomylitis	500 mg q 8h x2-4 weeks						
Ganciclovir	Induction	5 mg/kg q12h	50 to 69 2.5 mg/kg q 12h	25 to 49 2.5 mg/kg q 24h	24 to 10 1.25 mg/kg q 24h	1.25 mg/kg three times/ week		
	Maintenance	5 mg/kg q 24h	50 to 69 2.5 mg/kg q 24h	25 to 49 1.25 mg/kg q 24h	24 to 10 0.625 mg/kg q 24h	0.625 mg/kg three times/ week		

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Imipenem	Mild infection not pseudomonas	250 mg q 6h (1g/d)	See dosing table page 55-57					
	Moderate infection not pseudomonas	500 mg q 8h (1.5g/d)	See dosing table page 55-57					
	Severe infection not pseudomonas	500 mg q 6h (2g/d)	See dosing table page 55-57					
	Mild infection with pseudomonas	500 mg q 6h (2g/d)	See dosing table page 55-57					
	Moderate infection with pseudomonas	1g q 8h (3g/d)	See dosing table page 55-57					
	Severe infection with pseudomonas	1g q 6h (4g/d)	See dosing table page 55-57					
	Uncomplicated UTI	250 mg q 6h	See dosing table page 55-57					
	Complicated UTI	500 mg q 6h	See dosing table page 55-57					

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Levofloxacin	Community Acquired Pneumonia/ Bronchitis/ Sinusitis	500 mg q 24h x7-14d		20-49 500 mg x1 then 250 mg q 24h	10-19 500 mg x1 then 250 mg q 48h	500 mg x1 then 250 mg q 48h		
	Nosocomial Pneumonia	750 mg q 24h x7-14d		20-49 750 mg q 48h	10-19 750 x1 then 500 mg q 48h	750 x1 then 500 mg q 48h		
	UTI (complicated, uncomplicated, Pyelonephritis)	250 mg q 24h		20-49 250 mg q 24h	10-19 250 mg q 48h	250 mg q 48h		

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Meropenem	Pneumonia/ UTI/Gynae/Skin & Soft tissue	500mg q 8h	26-50 500mg q 12h	10-25 250mg q 12h	<10 250 mg q 24h		500mg x1	
	Nosocomial pneumona/ perotinitis/ neutropenia	1g q 8h	26-50 1g q 12h	10-25 500 mg q 12h	<10 500 mg q 24h		1g x1	
	Meningitis	2g q 8h	26-50 2g q 12h	10-25 1 g q 12h	<10 1 g q 24h		2g x1	
Metronidazole	Intra-abdominal Infections	15 mg/kg x1 iv then 7.5mg/kg iv q 6h			<10 7.5 mg/kg x iv then 3.25mg/kg iv q 6h	15 mg/kg x1 iv then 7.5 mg/kg iv q 6h	-	As <10
	Amebic Liver abscess or dysentery	750 mg po q 8h			<10 375 mg po q 8h	375 mg po q 8h	-	As <10

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
	Anaerobic Infections	7.5 mg/kg po q 6h			<10 3.25 mg/kg q 6h	3.25 mg/kg q 6h	-	As <10
	C. diff	500 mg q 8h			<10 250mg q 8h	500mg q 8h		As <10
	Giardiasis	250 mg q 8h			<10 125 mg q 8h	250 mg q8h		As <10
Pipercillin / Tazobactam	Moderate to Severe infections not pseudomonas	4.5g q 8h or 3.375 g q 6h		20-40 2.25g q6h	<20 2.25g q 8h	2.25g q12h	1.125g	2.25g q 12h
	Nosocomial PNA and pseudomonas infections	4.5g q 6h		20-40 3.375g q6h	<20 2.25g q 6h	2.25g q 8h	1.125g	2.25g q 12h
Polymyxin B		1.5-3 mg/kg/d div. BD		30-80 1-1.5 mg/kg/d	<25 1-1.5 mg/kg q 2-3d	1 mg/kg q 5-7d		

Antibiotic	Indication	Dose in Normal Renal Function	Dose in Mild Renal Failure	Dose in Moderate Renal Failure	Dose in Severe Renal Failure	HD	Supple-ment	PD
Trimethoprim /Sulfamethoxazole	Sinusitis/ UTI	1 DS po q 12h		15-30 1 SS po q12h	<15 Not Rec	Not Rec		
	Diarrhea	1 DS po q 12h x5d		15-30 1 SS po q12h	<15 Not Rec	Not Rec		
	Bronchitis	1 DS po q 12h x14d		15-30 1 SS po q12h	<15 Not Rec	Not Rec		
Vancomycin		1 g q 12h or 500mg q 6h		10-50 500mg q 24-48h	<10 500mg q 48-96h			

Dosing Table for Imipenem

Creatinine Clearance

Total Daily Dose	1.0 g				1.5 g			
Body Weight (Kg)	71	41 - 70	21 - 40	6 - 20	71	41 - 70	21 - 40	6 - 20
>70	250 mg q6h	250 mg q8h	250mg q12h	250mg q12h	500 mg q8h	250 mg q6h	250 mg q8h	250mg q12h
60-69	250 mg q8h	125 mg q6h	250mg q12h	125mg q12h	250 mg q6h	250 mg q8h	250 mg q8h	250mg q12h
50-59	125 mg q6h	125 mg q6h	125mg q8h	125mg q12h	250 mg q6h	250 mg q8h	250mg q12h	250mg q12h
40-49	125 mg q6h	125 mg q8h	125mg q12h	125mg q12h	250 mg q8h	125 mg q6h	125 mg q8h	125mg q12h
<30	125 mg q8h	125 mg q8h	125mg q12h	125mg q12h	125 mg q6h	125 mg q8h	125 mg q8h	125mg q12h

Dosing Table for Imipenem

Total Daily Dose	2.0 g				3.0 g			
Body Weight (Kg)	71	41 - 70	21 - 40	6 - 20	71	41 - 70	21 - 40	6 - 20
>70	500 mg q6h	500 mg q8h	250 mg q6h	250mg q12h	1 g q8h	500 mg q6h	500 mg q8h	500mg q12h
60-69	500 mg q8h	250 mg q6h	250 mg q8h	250mg q12h	750 mg q8h	500 mg q8h	500 mg q8h	500mg q12h
50-59	250 mg q6h	250 mg q6h	250 mg q8h	250mg q12h	500 mg q6h	500 mg q8h	250 mg q6h	250mg q12h
40-49	250 mg q6h	250 mg q8h	250mg q12h	250mg q12h	500 mg q8h	250 mg q6h	250 mg q8h	250mg q12h
<30	250 mg q8h	125 mg q6h	125 mg q8h	125mg q12h	250 mg q6h	250 mg q8h	250 mg q8h	250mg q12h

Dosing Table for Imipenem

Total Daily Dose	4.o g			
Body Weight (Kg)	71	41 - 70	21 - 40	6 - 20
>70	1 g q6h	750 mg q8h	500 mg q6h	500mg q12h
60-69	1 g q8h	750 mg q8h	500 mg q8h	500mg q12h
50-59	750 mg q8h	500 mg q6h	500 mg q8h	500mg q12h
40-49	500 mg q6h	500 mg q8h	250 mg q6h	250mg q12h
<30	500 mg q8h	250 mg q6h	250 mg q8h	250mg q12h

List of Experts for Advice

Readers may refer antibiotic management problems to the following experts for advice:

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