RATIONAL USE OF ANTIBIOTICS

SADAGOBAN

GENERAL PRINCIPLES IN THE USE OF ANTIBIOTICS

Introduction

Antibiotics are one of the most commonly prescribed drugs today. Rational use of antibiotics is extremely important as injudicious use can adversely affect the patient, cause emergence of antibiotic resistance and increase the cost of health care. Prescribing an antibiotic comprises several phases:

i) perception of need - is an antibiotic necessary ?
ii) choice of antibiotic - what is the most appropriate antibiotic ?
iii) choice of regimen : what dose, route, frequency and duration are needed ?
iv) monitoring efficacy : is the treatment effective ?

Is an antibiotic necessary?

Antibiotics are generally only useful for the treatment of bacterial infections. It is important to remember that not all fevers are due to infections and not all infections are caused by bacteria. The majority of infections seen in general practice are of viral origin and antibiotics can neither treat viral infections nor prevent secondary bacterial infections in these patients. Even where a bacterial aetiology is established, an antibiotic may not be always necessary. Many bacterial infections resolve spontaneously. Minor superficial skin infections may be more suitably treated with a local antiseptic. Collections of pus should be drained surgically and if drainage is adequate, antibiotics are often not required.

Choice of an antibiotic

The successful outcome of therapy would depend very much on the choice of the antibacterial agent. In the process of selecting an antibiotic, three main factors need to be considered; the aetiological agent, the patient and the antibiotic.

The aetiological agent

Determination of the aetiological agent depends on a combination of clinical acumen and laboratory support. In many instances an antibiotic prescription has to be made based on the clinical diagnosis (empirical therapy). Even where a bacteriology report is available it is necessary to interpret the report. Bacterial isolates from culture specimens may represent normal flora, colonisers or contaminants rather than true pathogens. Sensitivity results when available are at best only a guide to treatment. Laboratory reports should always be viewed in the light of clinical findings.

The patient

Several patient factors have to be considered in selecting an antibiotic. Age is an important factor. The very young and the very old tend to be more prone to the adverse effects of the antibiotics. Neonates have immature liver and renal functions which affect their ability to

metabolise or excrete antibiotics. Antibiotics and their metabolites may adversely affect growing tissues and organs in children. Elderly patients are more likely to suffer from nephrotoxicity and allergic reactions. Dosage modifications would also have to be made in those patients with hepatic or renal impairment. Antibiotics can also give rise to severe toxic reactions in patients with certain genetic abnormalities eg sulphonamides in patients with glucose-6-phosphate dehydrogenase deficiency. Antibiotics should as far as possible be avoided in pregnancy and when it is necessary to use an antibiotic, betalactam antibiotics and erythromycin are probably the safest. A history of allergy to antibiotics should always be sought before administration. Routine intradermal test doses for penicillin allergy is of little value and may even be dangerous. If in doubt avoid betalactams and use a macrolide or tetracycline (in adults) instead. In serious infections like meningitis and bacteraemic shock the immediate institution of the best available antibiotic for the suspected pathogen(s) is imperative as delay in treatment will increase both mortality and morbidity. In less serious situations such as otitis media where spontaneous recovery is common, an antibiotic that covers for the predominant organisms is adequate.

The antibiotic

The clinician should have adequate knowledge of the pharmacokinetic properties of the antibiotic he uses. Antibiotics vary in their ability to be absorbed orally or to cross the blood brain barrier and these factors will affect their routes of administration. The ability of the antibiotic to achieve therapeutic concentrations at the site of infection is another important consideration thus antibiotics used for treating urinary infections should ideally be concentrated in urine. Some antibiotics have very severe toxic effects and are best avoided in certain conditions. The doctor should also be aware of drug-drug interactions since many antibiotics can interact with other non-antibiotic drugs. Finally the cost of the antibiotic is also of major concern. In calculating costs it is perhaps more reasonable to take into account the total cost of treatment rather than just the actual cost of antibiotic per dose. The route of administration, the necessity for monitoring antibiotic levels and the patient's length of stay in hospital can affect the cost of treatment as well. The patient's compliance to medication is an important factor for consideration in the choice of antibiotics.

Choice of regimen

Parenteral or oral

Whether the route of administration should be oral or parenteral would depend on whether the patient is able to take oral treatment reliably. In cases of severe sepsis where rigors, hyperthermia/hypothermia, tachycardia and hypotension are present, intravenous therapy should be instituted. When in doubt it would be safer to commence intravenous treatment and review the treatment daily.

Duration of treatment

Except for a few conditions, the optimum duration of antibiotic treatment is unknown. Many antibiotics are often presribed for a duration of 5-7 days. Nevertheless it is reasonable to discontinue therapy even after a shorter period if the patient's symptoms have resolved. There are however certain infections where prolonged treatment is necessary (Table I). In some conditions eg uncomplicated cystitis in women and gonococcal urethritis in males, single dose regimens have been shown to be effective.

Table I. Conditions where a minimum duration of treatment has been established.

Infection	Minimum duration of treatment

Tuberculosis	4 -6 months
Empyema and lung abscess	4 - 6 weeks
Endocarditis	4 weeks
Osteomyelitis	4 weeks
Atypical pneumonia	2 - 3 weeks
Pneumococcal meningitis	7 days
Pneumococcal pneumonia	5 days

Monitoring efficacy

Early review of response

A routine early review (3 days after commencing treatment) of the patient's response is important in order to ensure that the patient is receiving appropriate treatment. After review the doctor will have to decide whether to:

i) continue with the present regimen
ii) increase the level of treatment by changing from oral to parenteral; increasing the dose or
changing to a broader spectrum antibiotic
iii) decrease the level of treatment by changing from parenteral to oral, decreasing the dose or
changing to a more specific narrow spectrum antibiotic
iv) stopping the antibiotic if the infection has resolved; the objective of treatment is achieved or
the diagnosis has been changed.

Inconsistent microbiology reports

If the patient is responding there is no necessity to change antibiotic even when the laboratory reports a resistant organism. The isolate in question could have been a coloniser or a contaminant. Infections may resolve spontaneously and the antibiotic could have affected the bacteria in a way that makes it more susceptible to the host's immune defenses.

If the patient's condition fails to improve, a change in antibiotic may be necessary even when the laboratory reports a sensitive organism.

Causes of non-response to antibiotics

A patient may fail to respond to an antibiotic for a number of reasons which include:

i) the aetiological agent is resistant to the antibiotic
ii) the diagnosis is incorrect
iii) the choice of antibiotic is correct but the dose and/or route of administration is wrong
iv) the antibiotic cannot reach the site of infection
v) there is a colletion of pus that should be drained surgically or a foreign body/devitalised tissue that should be removed

vi) there is secondary infection
vii) antibiotic fever
viii) non-compliance of the host

Changing from intravenous to oral
Wherever feasible intravenous therapy should be changed to oral therapy. The oral antibiotic (not necessarily the oral preparation of the intravenous antibiotic) should be selected based on clinical and laboratory findings. Similarly one should not hesitate to revert to intravenous therapy if the patient's condition warrants it.

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GUIDELINES ON ANTIBIOTIC THERAPY

The following guidelines are issued for the more common infections only. However even for common infections they may not apply to certain patients. When in doubt always seek a second opinion. The recommendations for first and second choice regimens are based on a global assessment of efficacy, adverse effects , prevailing sensitivity patterns and cost. It should also be noted that guidelines such as these have to be reviewed and updated from time to time.

NOTE :

1. Erythromycin may be substituted for by a newer macrolide.
2. Gentamicin may be substituted for by another aminoglycoside depending on the local prevailing sensitivity pattern.
3. Where ampicillin is recommended amoxycillin may also be used. Ampicillin/amoxycillin may be substituted for by a betalactam/betalactamase inhibitor combination depending on the local prevailing sensitivity pattern.
4. Cloxacillin is the drug of choice for severe methicillin-sensitive *Staphylococcus aureus*. For oral therapy flucloxacillin is preferred to cloxacillin as the former is more reliably absorbed and achieves higher tissue levels. In some children who cannot tolerate cloxacillin a first or second generation cephalsoporin may be used.
5. Quinolones are not recommended in children.

Abbreviations:

1o : First generation
2o : Second generation
3o : Third generation

Table 1. RESPIRATORY INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Acute pharyngitis/tonsillitis,	Penicillin V	Erythromycin	The majority of sore throats are viral in

scarlet fever (*Streptococcus pyogenes* suspected or proven)			origin and antibiotics are not indicated for treatment or prevention of secondary bacterial infections.
Diphtheria (*Corynebacterium diphtheriae*)	Benzylpenicillin		Antibiotics are not the mainstay of treatment. Antitoxin and supportive treatment are critical in management. Close contacts should receive erythromycin. Non-immunised contacts should be immunised.
Acute otitis media and acute sinusitis (*Strep pneumoniae, Haemophilus influenzae & Moraxella catarrhalis*)	Ampicillin or Betalactam/ betalactamase inhibitor combination	New macrolides	Most strains of *Strep pneumoniae* and *Haemophilus influenzae* in Malaysia are sensitive to ampicillin. However many strains of *Moraxella catarrhalis* are resistant to ampicillin.
Acute epiglottitis (*Haemophilus influenzae*)	Chloramphe-nicol	Ampicillin or 3o cephalo-sporin	Acute epiglottitis is a medical emergency and hospitalisation with aggressive therapy is required
Pertussis (*Bordetella pertussis*)	Erythromycin		Antibiotic treatment does not significantly alter the course of disease. If given early it helps to eradicate oropharyngeal organisms thus

			interrupting transmission.

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Acute bronchitis (2o bacterial infections due to *Streptococcus pneumoniae* & *Hae-mophilus influenzae*)	Ampicillin	Erythromycin or Doxycycline (adults only)	Acute bronchitis is primarily a viral infection and antibiotics are **not indicated.** However 2o bacterial infection may occur in severe cases. Erythromycin is preferred if *Mycoplasma* is suspected on epidemiological or other grounds.
Acute exacerbations of chronic bronchitis (*Streptococcus pneumoniae, Hae-mophilus influenzae, Moraxella catarrhalis*)	Ampicillin or Betalactam/ betalacta-mase inhibitor combination	Erythromycin or Doxycycline (adults only)	
Acute bronchial asthma	Antibiotics are not indicated		There is no evidence that antibiotics will significantly alter outcome.
Pneumonia Community acquired pneumonia - mild to moderate (*Streptococcus pneumoniae, Hae-mophilus influenzae, Mycoplasma*) **Community acquired**	Benzylpenicillin or Ampicillin or Erythromycin Benzylpenicillin and Gentamicin	 Betalactam/ betalacta-mase	Erythromycin is preferred when *Mycoplasma* is suspected. When *Staph aureus* is suspected or demonstrated

pneumonia - severe (*Streptococcus pneumoniae, Hae-mophilus influenzae, Staphylococcus aureus, Klebsiella pneumoniae*)	or 2o or 3o Cephalo-sporin	inhibitor combination	use cloxacillin and gentamicin.
Atypical pneumonia (*Mycoplasma pneu-moniae*, chlamydia, *Legionella*)	Erythromycin or Doxycycline (for adults)		
Chlamydia trachomatis penumonia in infancy	Erythromycin		Transmitted from mother. Usually becomes clinically apparent 2 - 20 weeks after birth.

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Nosocomial pneumonia **Post-operative/coma (**aerobic gram negative bacilli, streptococci, anaerobic mouth flora, *Staphylococcus aureus*) **severe cases** **where MRSA is demonstrated or strongly suspected** **ventilated patients (***Pseudomonas aeruginosa*, other	Benzylpenicillin and Gentamicin 3o Cephalo-sporin and Gentamicin Vancomycin Gentamicin and		If vancomycin is not available a combination of fucidin and rifampicin may be used

aerobic gram negative bacilli) **immunosuppressed (**aerobic gram negative bacilli and *Staphylo-coccus aureus*	a 3o Cepha-losporin Gentamicin and a 3o Cephaloporin or Ureido-penicillin or Carbapenem		Pneumonia in the immunocompromised may also be caused by a variety of non-bacterial agents eg fungi (*Candida, Aspergillus*), *Toxoplasma, Pneumocystis* and viruses.
Lung abscess/ empyema (mixed infection of anaerobes, *Staphylococcus aureus, Streptococcus pneumoniae* and aerobic gram negative bacilli)	Benzylpenicillin and Gentamicin and Metronida-zole		Empyema in childhood is nearly always due to staphylococci. Where staphylococci is suspected substitute cloxacillin for benzyl penicillin

Table 2. URINARY TRACT INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Acute urinary tract infection (*E. coli, Staphylococcus saprophyticus***)**	Cotrimoxa-zole or Trimethoprim or Ampicillin or Nitrofurantoin	1o/2o cephalo-sporin	Many hospital acquired pathogens are now resistant to ampicillin. In uncomplicated cystitis in adults 4 tabs cotrimoxazole in a single dose has been shown to be effective.

			In pregnancy ampicillin should be given for 10 days
Pyelonephritis and complicated urinary tract infection (*E. coli*, other *Enterobacteriaceae*)	2o Cephalo-sporin and Gentamicin or a quinolone		In all cases an attempt should be made to exclude any underlying abnormality
Recurrent urinary infection (*E. coli,* other *Enterobacteriaceae*, enterococci)	Cotrimoxazole 1 tab nightly or Nitrofurantoin 50 mg nightly	Ampicillin 500 mg nightly or Cephalexin 250 mg nightly or Nalidixic acid 500 mg nightly	Recurrent urinary tract infections may require very prolonged prophylaxis. Female patients should be advised on perineal hygiene and micturition after intercourse. Treat current infection before starting on prophylaxis. Cotrimoxazole should be avoided during the 3rd trimester of pregnancy.
Catheter associated infections ***(****Enterobacteriaceae, Pseudomonas and Enterococcus)*	Treat accord-ing to culture & sensitivity report		Isolation of bacteria in urine culture per se is not an indication while catheter is in-situ. Antibiotics will not eradicate the bacteria and may promote resistance instead. Treatment is only necessary is systemic signs are present and based on the most recent culture. Catheter care is all important. Bladder irrigation is generally not useful and may introduce infection. The catheter should be removed as early

			as it is possible. If the catheter is changed in the presence of bacteriuria, a single prophylactic dose of antibiotic should be given 30 minutes before the procedure.
Acute urinary infection in children *(E. coli* and other *Enterobacteriaceae)* **Mild** **Severe**	Cotrimoxa-zole or Ampicillin or Oral 1o cephalo-sporin 2o/3o cephalosporin or aminoglycoside		In all cases assessment of renal function (cystograms, ultrasound of kidneys, ureters and bladder) should be performed. Prophylactic antibiotics for children < 4 years is recommended in cases where anatomical abnormalities are detected.

Table 3. SKIN AND SOFT TISSUE INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Impetigo (*Strep pyogenes, Staph aureus***)**	Penicillin	Erythromycin or Cloxacillin and Penicillin or Cephalexin	Mupirocin ointment may be considered for topical use in cases of MRSA infections.
Boils and carbuncles (*Staph aureus***)**	Erythromycin	Cloxacillin or Cephalexin	Surgical drainage is the definitive mode of treatment and antibiotics may not be necessary if

			drainage is adequate.
Cellulitis/Erysipelas/ Lymphangitis **(***Strep pyogenes)* *Severe cases* ***Mild to moderate cases*** ***Facial and orbital cellulitis in children*** ***(****Haem influenzae)*	Benzylpenicillin or Procaine penicillin Penicillin V or Erythromycin 2o or 3o Ceph-alosporin		Change to oral therapy once patient's condition improves. If staphylococci suspected or proven use a combination of penicillin and cloxacillin
Decubitus ulcers (*Enterobacteriaceae, Pseudomonas, Enterococcus,* anaerobic bacteria)	Antibioticsare **not indicated** unless systemic symptoms are present.		2o Cephalosporin and Metronidazole may be used in cases with systemic symptoms
Diabetic foot infections **(**Polymicrobial infection - *Enterobacteriaceae, Staph aureus,* streptococci, anaerobic bacteria)	2o or 3o Cephalo-sporin and Metronida-zole or Betalactam-betalacta-mase inhibitor combination	Cloxacillin and Gentamicin and Metronida-zole	Diabetic foot infections may involve extensive tissue and bone necrosis. Surgical debridement is often necessary. The duration of treatment depends on the response.
Infected bites **(**animal bites : *Pastuerella multocida,* staphylococci **human bites : mouth flora)**	Ampicillin and/or Cloxacillin	Erythromycin	Tetanus toxoid should be administered to patients requiring a booster. The value of antibiotic prophylaxis in clinically

			uninfected bites is not proven. For hand wounds and extensive injuries a 5 day course of antibiotics is advised. Human bites may have medicolegal implications and proper documentation including photographs may be necessary.
Umbilical sepsis			Antibiotics are generally not indicated. Where there is evidence of spread a course of cloxacillin is recommended.
Lymphadenitis *(Staph aureus, Strep pyogenes)*	Cloxacillin or Erythromycin or 1oCephalosporin		

Table 4. MUSCULOSKELETAL INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Acute osteomyelitis (*Staph aureus* - commonest; others include *Enterobacteriaceae, Pseudomonas*) **In children < 5 yr staphylococci,**	Cloxacillin	Fusidic acid	For children < 5 yr use a combination of cloxacillin and 2o/ 3o Ceph-alosporin

streptococci and *Haem influenzae*			
Chronic osteomyelitis (*Staph aureus, Enterobacteriaceae, Pseud aeruginosa***)**	Cloxacillin	Fucidic acid and Rifampicin *or according to culture report*	Where MRSA is suspected or proven, fucidic acid and rifampicin should be 1st choice antibiotics. For cases due to *Pseud aeruginosa,* an antipseudomonal fluroquinolone may be considered.
Septic arthritis (> 5 years : *Staph aureus;* < 5 years : *Staph aureus, Haem influenzae*)	Cloxacillin		For children < 5 yr use a combination of cloxacillin and 2o/ 3o Ceph-alosporin
Compound fractures (*Staph aureus,* gram negative bacilli) **Grade I fractures** **Grade II fractures** **Grade III fractures**	2o or 3o Ceph-alosporin 2o or 3o Ceph-alosporin and Gentamicin 2o or 3o ceph-alosporin and Gentamicin and Metronidazole		The optimum duration of antibiotic administration has not been established. No differences have been shown in 1,3 or 5 day courses. Infection is more likely in Grade 3 fractures with severe soft tissue and vascular injuries. Routine cultures should be taken and the antibiotics changed if necessary. This especially so for cases where surgery is delayed. Early surgical debridement and adequate fracture stabilisation within 6-8 hours of injury is the most important aspect of treatment.
Gas gangrene (*Clostridium* sp)	Benzylpenicillin		Use 4 mega 6 hrly

Table 5. GASTROINTESTINAL INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Gingivitis (Spirochaetal organisms, streptococci and oral anaerobes)	Penicillin V and Metronida-zole		
Periodontal infections **(**Streptococci and oral anaerobes)	Penicillin V	Erythromycin	
Oral thrush **(***Candida albicans* and other candida species)	Syrup Nystatin	Azole (oral gel)	
Acute cholecystitis (*Enterobacteriaceae, Enterococcus* and *Bacteroides*)	2o or 3o Ceph-alosporin with or without Metronidazole	Gentamicin with or without Metronidazole	
Acute cholangitis (*Enterobacteriaceae, Bacteroides*)	Ampicillin or 2o or 3o Ceph-alosporin	Gentamicin	
Acute peritonitis *Primary (children)* (*Strep pneumoniae,* other streptococci, staphylococci, *Enterobacteriaceae*) *Primary (adults with cirrhosis)* (*Enterobacteriaceae)* ***Secondary*** **(**polymicrobial infection due to *Enterobacteriaceae,*	Penicillin and gentamicin 3o Cephalo-sporin 2o/3o cephalo-sporin	3o Ceph-alosporin Gentamicin Gentamicin and	

Enterococcus and *Bacteroides*)	and methronida-zole	Metronida-zole	
Antibiotic associated colitis (*Clostridium difficile*)	Vancomycin (oral) or Metronidazole		
Enteric fever (*Salmonella typhi, Salmonella paratyphi*)	Chloramphe-nicol or Cotrimoxazole or Ceftriaxone	Ampicillin or Quinolone	The majority of strains of *Salmonella typhi* isolated in Malaysia are still sensitive to chloramphenicol. The newer fluoroquinolones have been shown to be effective for the treatment of carriers.
Acute uncomplicated diarrhoeas (viruses, *E. coli, Salmonella sp, Shigella sp, Campylobacter*)	No antibiotic necessary		Oral rehydration salt solutions (ORS) should be given for replacement therapy. Salmonella sepsis is not uncommon in severely ill infants and a 3o cephalosporin is indicated when suspected.

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Cholera (*Vibrio cholerae* O1, O139)	Doxycycline for 4 days		Replacement of fluids and correction of electrolyte imbalances are the mainstay of treatment. Use syrup tetracycline in children.
Bacterial dysentery (*Shigella, Salmonella, enteroinvasive E. coli)*	Cotrimoxazole (Only in severe dysentery)		*Shigella in Malaysia is often resistant to multiple antibiotics. For such strains the use of a quinolone may be considered.*

Amoebic dysentery (*Entamoeba histolytica*)	Metronidazole	Tinidazole	
Liver abscess ***Pyogenic*** (coliforms, staphylococci, micro-aerophilic streptococci) ***Amoebic*** (*Entamoeba histolytica)*	Ampicillin and Metronida-zole Metronida-zole	2o or 3o ceph-alosporin and Metronida-zole Tinidazole	

Table 6. GENITOURINARY INFECTIONS (INCLUDING SEXUALLY TRANSMITTED DISEASES)

Note : For all sexually transmitted diseases every effort should be made for contact tracing and treatment of the sexual partners.

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Pelvic inflammatory disease (anaerobic bacteria, streptococci, *Entero-bacteriaceae*, chlamydia, *Neisseria gonorrhoeae*) **Mild to moderate** **Severe**	Doxycycline and Gentamicin and Metronida-zole Doxycycline and 2o or 3o cephalo-sporin and		

	Metronida-zole		
Vaginitis Candidal (*Candida albicans, Candida tropicalis,* other *Candida* spp)	Nystatin or Clotrimazole	Fluconazole or Ketoconazole or Itraconazole	
Trichomonal (*Trichomonas vaginalis*)	Metronida-zole or Tinidazole		**Metronidazole should be avoided during the first trimester.**
Bacterial vaginosis (*Gardnerella vaginalis, Mobiluncus, Bacteroides* sp)	Metronida-zole or Tinidazole	Ampicillin	**With recurrent infections consider treatment for the sexual partner as well.**
Gonorrhoea (*Neisseria gonorrhoeae)* Uncomplicated urethritis, rectal and pharyngeal gonorrhoea	Spectino-mycin or Ceftriaxone or Ciprofloxacin		**For uncomplicated urethritis, rectal and pharyngeal gonorrhoea single dose treatment is sufficient.**
Pelvic inflammatory disease	Spectino-mycin or 2o or 3o Cephalo-sporin		**For other forms of gonorrhoea, three day courses are required.**
Adult gonococcal ophthalmia	Ceftriaxone or Spectino-mycin		
Gonococcal ophthalmia neonatorum			**In gonococcal ophthalmia parenteral antibiotics should be accompanied by hourly conjunctival**

			irrigation with saline or antibiotic eyedrops.
Non-gonococcal urethritis (*Chlamydia tra-chomatis, Ureaplasma urealyticum*)	Doxycycline or Erythromycin		Doxycycline or erythromycin should be given for at least seven days. With certain newer macrolides single dose regimens have been shown to be effective.
Inclusion conjunctivitis (adults) (*Chlamydia tra-chomatis*)	Doxycycline or Erythromycin		Duration of treatment should be fourteen days.
Syphilis (*Treponema pallidum*) **Early** **Late** **Neurosyphilis** **Congenital syphilis**	 Procaine penicillin (10 days) or Benzathine penicillin (2 weekly doses) Procaine penicillin (21 days) or benzathine penicillin (3 weekly doses) Procaine or Benzyl pencillin (21 days) Benzyl-penicillin		***For patients allergic to penicillin*** **Erythromycin or doxycycline for 30 days** **Erythromycin or doxycycline for 30 days** **Doxycycline for 30 days** **Asymptomatic babies born of syphilitic mothers should also be treated**
Chancroid (*Haemophilus ducreyi*)	Cotrimoxazole or Ceftriaxone		Bubos should be aspirated, not incised and drained.

Table 7. CENTRAL NERVOUS SYSTEM INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Meningitis (*Haemophilus influen-zae, Streptococcus pneumoniae, Neisseria meningitidis*) **Adult** **Children** **Neonatal meningitis**	Benzyl penici-llin and Chlor-amphenicol or 3o Cephalo-sporin Ampicillin and Chloramphe-nicol or 3o cephalo-sporin Ampicillin and gentamicin or 3o cephalo-sporin		When the pathogen is known the antibiotic of choice for pneumococcal and meningococcal meningitis is benzyle penicillin. For haemophilus meningitis chloramphenicol or a 3o cephalosporin is the drug of choice. Meningitis caused by penicillin resistant pneumococci and ampicillin/chloram-phenicol resistant haemophilus are still uncommon in Malaysia. Many laboratories have rapid diagnostic kits and results can often be obtained within a few hours.
Cryptococcal meningitis (*Cryptococcus neoform-ans*)	Amphotericin B and 5 Flu-cytosine		Fluconazole may be considered as an alternative drug for cryptococcal meningitis.
Brain abscess (adults) (Streptococci, anaerobic organisms)	Benzylpenicillin and	3o Cephalo-sporin	Surgical drainange is the definitive

Brain abscess (children) (Staphylococci, streptococci, gram negative aerobic bacilli and anaerobic organisms)	Metronidazole Cloxacillin and 3o cephalo-sporin and Metronidazole	and Metronidazole	treatment for brain abscess.

Table 8. CARDIOVASCULAR INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Endocarditis **Non-intravenous drug user** (Streptococcus viridans group) **Intravenous drug user** (*Staphylococcus aureus*) **Post-surgical endocarditis** (Staphylococci, diphtheroids)	Benzylpenicillin and Gentamicin Cloxacillin and Gentamicin Cloxacillin and Gentamicin		**Dosage:** Penicillin 2-3 mega iv, 4-6 hrly for 4-6 weeks Gentamicin 1.0 mg/kg iv, 8 hrly for 2-6 weeks Cloxacillin 2 g iv, 4hrly for 6 weeks. After 4 weeks of iv penicillin, replacement with oral penicillin plus probenecid can be considered. When endocarditis is shown to be due to *Enterococcus* use ampicillin 2 g iv 6hrly and gentamicin for **6 weeks**. Endocarditis in IDUs often involves the tricuspid valves and associated with pneumonia/lung abscess. Endocarditis in IDUs may occasionally be caused by gram negative bacilli in which case treatment should be based on the sensitivity report. For MRSA infections use vancomycin or a combination of fucidic acid and rifampicin. *Staphylococcus epidermidis*

			is often resistant to cloxacillin thus vancomycin may have to be used instead. Other bacteria and fungi can also cause post-surgical endocarditis and treatment will be according to culture report. Surgical intervention is often necessary for prosthetic valve infection.

Table 9. BACTERAEMIA AND SEPTICAEMIA

Condition (According to most likely focus	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Urinary (community acquired - *Enterobact-eriaceae, Enterococcus*) **Urinary (hospital acquired -** *Pseudomonas* and other gram negative aerobic bacilli)	Ampicillin and Gentamicin 2o or 3o generation Cephalo-sporin and Gentamicin		
Gall bladder/bowel (*Enterobacteriaceae, Enterococcus,* anaerobic organisms)	3ogeneration Cephalo-sporin and Metronida-zole	Gentamicin and Metronida-zole or Betalactam-betalactamse inhibitor combination and gentamicin	
Female pelvis *(Enterobacteriaceae, Enterococcus,*	Gentamicin and Metronida-zole	2o or 3o generation Cephalo-sporin	

anaerobic organisms)		and Metronida-zole	
Skin (cellulitis) (*Streptococcus pyogenes*) **Skin (abscess)** (*Staphylococcus aureus)* **Decubitus ulcers, diabetic foot ulcers** (Aerobic gram negative bacilli, anaerobic bacteria, staphylococci)	Benzylpenicillin Cloxacillin Cloxacillin and Gentamicin and Metronidazole	**Betalactam-betalactamse inhibitor combination and gentamicin**	
Intravascular lines (Staphylococci, *Enterobacteriaceae*)	Cloxacillin and Gentamicin		The infected line should be removed. Where MRSA and MRSE are prevalent use vancomycin or a combination of fucidic acid and rifampicin.
Lung - community acquired (*Staphylococcus aureus)* **Lung - hospital acquired** (*Staphylococcus aureus,* aerobic gram negative bacilli)	Cloxacillin and Gentamicin Cloxacillin and Gentamicin and Metronida-zole	3o generation Cephalo-sporin and Gentamicin and Metronida-zole	
Condition (According to most likely focus	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**	**Notes**

Neutropaenic	3o generation Cephalosporin and Gentamicin	Ureidopeni-cillin or carbapenem and Gentamicin	In a significant proportion of neutropaenic patients cultures are negative. Many authorities would recommend commencement of antifungal treatment if there is no response after 3 - 5 days of antibacterial treatment.

Table 10. OTHER INFECTIONS

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Scrub typhus (*Rickettsia tsutsugamushi*)	Tetracycline (to be given until at least 48 hours after fever has subsided) or Doxycycline for 3 days		If treatment is initiated before the fifth day of clinical disease, a further 3 day course 4 days later is required to prevent relapse.
Melioidosis (*Burkholderia pseudomallei)*	Ceftazidime for 14-21 days followed by Doxycycline or Cotrimoxazole or Amoxycillin/clav-ulanic acid for 3 months		Treatment for longer than 3 months may be necessary for some cases

Table 11. INFECTIONS ASSOCIATED WITH PREGNANCY
Antibiotics should be used with care in pregnancy. Beta-lactam antibiotics and macrolides are probably the safest antibiotics to use in pregnancy.

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes

Asymptomatic bacteriuria/ Cystitis (*E. coli*)	Ampicillin or Cephalexin		
Acute pyelonephritis (*E. coli* **)**	2o or 3o generation Cephalo-sporin	Ampicillin	
Condition	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**	**Notes**
Chorioamnionitis/ Prolonged rupture of membranes (Group B streptococci, anaerobes, *Enterobacteriaceae*)	2o or 3o generation Cephalosporin and Metronidazole	Ampicillin and Gentamicin and Metronidazole	
Puerperial and post-abortal sepsis (Streptococci, *Entero-coccus*, staphylococci, *Enterobacteriaceae*, anaerobes)	2o or 3o generation Cephalosporin and Metronidazole	Ampicillin and Gentamicin and Metronidazole	

Table12. CHEMOPROPHYLAXIS FOR SELECTED MEDICAL CONDITIONS

Condition	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**	**Notes**
Rheumatic fever	Benzathine penicillin 1.2 mega every 4 weeks	Penicillin V 250 mg 12 hrly or Erythromycin 250 mg 12 hrly	Prophylaxis should be maintained for many years. Children should continue to receive prophylaxis until the age of 25 years and adults for at least 5 years whichever is the longer.
Cholera	Tetracycline 1 g daily for 5 days or		

	Doxycycline 200 mg stat dose		

Condition	1st Choice antibiotic(s)	2nd Choice antibiotic(s)	Notes
Bacterial endocarditis For dental and upper respiratory procedures	Amoxycillin 3 g oral 1 hour before procedure or Ampicillin 1 g iv just before pro-cedure followed by 500 mg 6 hrs later		**Patients allergic to penicillin** Erythromycin 1.5 g orally 1 hour before procedure folowed by 500 mg 6 hours later or Vancomycin 1 g iv just before procedure
For patients who have prosthetic valves or previous endocarditis undergoing dental and upper respiratory procedures; and for patients undergoing genitourinary manipulation	Ampicillin 1 g iv just before procedure followed by 500 mg 6 hrs later and Gentamicin 1.5 mg/kg iv just before procedure and I dose 6 hr later		**Dosages for children:** Amoxycillin 50mg/Kg before and 25 mg/Kg after Gentamicin 2 mg/Kg before Cloxacillin 50 mg/Kg before Clindamycin is preferred in patients on long term penicillin
For patients with prosthetic valves undergoing cardiac catheterisation, pace-maker insertion and skin biopsy	Cloxacillin 1 g iv and Gentamicin 1.5 mg/kg iv just before procedure		

Post splectomised children	Penicillin V 250 mg 12 hrly or Benzathine penicillin 1.2 mega monthly		Pneumococcal vaccine should be given to the patient one month before splenectomy
Close contacts of meningococcal and haemophilus meningitis patients	Adults (menin-gococcal only) Rifampicin 600 mg 12 hrly for 2 days Children (Men-ingococcal and haemophilus) Rifampicin 10 mg/kg/day 12 hrly for 4 days		In meningococcal meningitis treatment of the patient with penicillin may not reliably clear the nasopharynx of meningococci. A prophylactic course of rifampicin is advised for the convalescent patient before discharge back to the family circle.

SURGICAL CHEMOPROPHYLAXIS

The use of antibiotic prophylaxis has been shown to prevent post-surgical wound infections. When employed rationally significant reductions in morbidity and mortality and savings in resources can be achieved. However when used excessively and in situations when its benefit has not been proven, perioperative antibiotics can lead to unjustifiably high costs of medical care. Single dose regimens or very short courses are unlikely to lead to emergence of bacterial resistance but routine prolonged courses have been clearly associated with increased rates of resistance.

Surgical operations can be divided into four broad categories :

- clean (eg breast, thyroid and hernia operations)
- clean contaminated (eg upper gastrointestinal and biliary)
- contaminated (eg colorectal and trauma surgery within 4 hours of injury)
- dirty (eg perforated intestinal viscus, trauma surgery after 4 hours of injury)

Prophylaxis is generally recommended for clean-contaminated and contaminated operations. In clean operations prophylaxis maybe justified if the consequence of infection is very serious eg in cardiac operations and orthopaedic implants.

Another factor which should be considered in determining probability of infection is the patient himself. Factors that reduce host defenses eg old age, malignancy, malnutrition, steroid therapy, etc will increase the risk of infection.

In using antibiotics for surgical chemoprophylaxis the following principles should be adhered to:

1. It is important to distinguish between prophylaxis and treatment. Prophylaxis is given when no infection exists previously. When an infection is already present, even when clinically not evident, treatment should be given.
2. Prophylaxis should be given only in certain conditions where the benefits clearly outweigh the risks. The cost of prophylaxis should also be considered.
3. The antibiotic should be directed at the most likely contaminating organism for that particular procedure. Choice of antibiotic will also depend on whether the patient has been in hospital for a prolonged period and the current pattern of antibiotic resistance in the hospital. In general the agent selected should (a) be of low toxicity (b) have an established safety record (c) reach a useful concentration in the relevant tissues.
4. The route of administration, timing and duration of giving the antibiotic is planned to achieve the maximum concentration of the antibiotic in the tissues during and shortly after the operation. Antibiotics are preferably given by the intravenous route at the time of induction of anaesthesia. In most instances a single pre-operative dose would suffice. Where surgery is prolonged additional intraoperative doses may be given. There is no evidence that there is any benefit in extending prophylaxis beyond 24 hours after the operation.
5. Topical antibiotics are not recommended with the exception of opthalmic surgery and cases of extensive skin loss.
6. Surgical chemoprophylactic regimens should be reviewed regularly and changes made if necessary.

GUIDELINES FOR SURGICAL ANTIBIOTIC PROPHYLAXIS

Gynaecologic surgery

Operative procedure	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**
Caesarean section (anaerobes, streptococci,	2o or 3o cephalosporin	1. Gentamicin and Metronidazole

aerobic gram-negative bacilli)		2. Ampicillin and Metronidazole
Hysterectomy (anaerobes, streptococci)	2o or 3o cephalosporin	Ampicillin and Metronidazole

General Surgery

Operative procedure	1st Choice antibiotic (s)	2nd Choice antibiotic(s)
Cholecystectomy (open and laparoscopic) (Aerobic gram-negative bacilli, enterococci, anaerobes)	2o or 3o cephalosporin	1. Beta-lactam/beta-lactamase inhibitor 2. Gentamicin
Oesophageal/gastric surgery (Aerobic gram-negative bacilli, streptococci)	2o or 3o cephalosporin	Beta-lactam/betalactamase inhibitor
Colorectal surgery (Anaerobes, aerobic gram-negative bacilli, enterococci)	2o or 3o cephalosporin and Metronidazole	Gentamicin and Metronidazole
Appendicectomy (Anaerobes, aerobic gram-negative bacilli, enterococci)	2o or 3o cephalosporin and Metronidazole	Gentamicin and Metronidazole

Vascular Surgery

Operative procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)
Arterial replacement/ by-pass surgery	2o cephalosporin	Cloxacillin and Gentamicin

Cardiac Surgery

Operative Procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)

Valve replacement and coronary grafts	2o or 3o cephalosporin	

Thoracic Surgery

Operative Procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)
Lobectomy and pneumonectomy	2o or 3o cephalosporin	

Orthopaedic Surgery

Operative Procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)
Arthroplasty and joint replacements (Staphylococci)	Cloxacillin and Gentamicin	2o cephalosporin
Open reduction of fractures (Staphylococci)	Cloxacillin and Gentamicin	2o cephalosporin

ENT Surgery

Operative Procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)
Major oral, head and neck surgery (streptococci, anaerobes, aerobic gram-negative bacilli)	2o or 3o cephalosporin and Metronidazole	

Neurosurgery

Operative Procedure	1st Choice antibiotic(s)	2nd Choice antibiotic(s)
Craniotomy (Staphylococci)	2o cephalosporin	Cloxacillin and Gentamicin

Shunt procedures (Staphylococci)	2o cephalosporin	Cloxacillin and Gentamicin

Urological surgery

Operative Procedure	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**
Stone surgery and prostatectomy (Enterobacteriaceae)	2o or 3o cephalosporin	Gentamicin

Endoscopic procedures
Antibiotic prophylaxis for endoscopic procedures are given for 2 main reasons:
1) to prevent endocarditis (see table below for degree of risk)
2) to prevent infective complications

Operative Procedure	**1st Choice antibiotic(s)**	**2nd Choice antibiotic(s)**
Hepatobiliary, pancreatic *in the presence of obstruction* (Enterobacteriaceae)	2o or 3o cephalosporin	Gentamicin
Cystoscopy, nephroscopy and stents (Enterobacteriaceae)	2o or 3o cephalosporin	Gentamicin
Arthroscopy (Staphylococci)	2o cephalosporin	Cloxacillin and Gentamicin

Estimated risk of endocarditis associated with preexisting cardiac disorders.
(From New Engl J Med 1995, 323:39)

Relatively high risk	**Intermediate risk**	**Very low or negligible risk**
Prosthetic heart valves Previous endocarditis Cyanotic congenital heart failure	Mitral valve prolapse with regurgitation Pure mitral stenosis Tricuspid valve disease	Mitral valve prolapse without regurgitation Trivial valvular regurgitation on

Patent ductus arteriosus Aortic regurgitation Aortic stenosis Mitral regurgitation Mitral stenosis and regurgitation Ventricular septal defect Coartation of the aorta Surgically repaired intracardiac lesions with residual haemodynamic abnormality	Pulmonary stenosis Asymmetric septal hypertrophy Bicuspid aortic valve or calcific aortic sclerosis with minimal haemodynamic abnormality Degenerative valvular disease in elderly patients Surgically repaired intracardiac lesions with no haemodynamic abnormality, less than 6 months after the operation	echocardiography without structural abnormality Isolated atrial septal defect Arteriosclerotic plaques Coronary artery disease Cardiac pacemaker Surgically repaired intraccardiac lesions, with minimal or no haemodynamic abnormality, more than six months after operation

ANTIBIOTIC DOSAGES FOR ADULTS

Note : The following dosing guidelines are the usually recommended regimens. They may not apply to all patients nor to all infections. When in doubt always consult a specialist.

Antibiotic	Usual oral regimen	Usual parenteral regimen
Amphotericin B		0.25 - 1.5 mg/kg/day
Amikacin		7.5 mg/kg 8 hrly
Amoxycillin	250 - 500 mg 8 hrly	
Amoxycillin-Clavulanate	250 - 500 mg 8 hrly (based on amoxycillin)	
Ampicillin	250 - 500 mg 6hrly	1 - 2 g 6 hrly
Ampicillin-sulbactam (Sultamicillin)	375 - 750 mg 12hrly	1 - 2 g 6hrly or 8 hrly
Azithromycin	500 mg dly	
Bacampicillin	400 - 800 mg 12 hrly	
Carbenicillin	500 mg - 1 g 6 hrly	5 - 6 g 6 hrly
Cefoperazone		1 - 2 g 8 - 12 hrly

Cefotaxime		1 - 2 g 8 - 12 hrly
Ceftazidime		1 - 2 g 8 - 12 hrly
Ceftriaxone		500 mg - 1 g 12 - 24 hrly
Cefuroxime	250 mg 12 hrly	750 mg - 1.5 g 8 - 12 hrly
Cephalexin	250 mg - 1 g 6 hrly	
Chloramphenicol	250 - 750 mg 6 hrly	250 mg - 1 g 6 hrly
Ciprofloxacin	250 - 750 mg 12 hrly	400 mg 12 hrly
Clarithromycin	250 - 500 mg 12 hrly	
Clindamycin	150 - 300 mg 6 hrly	300 - 900 mg 6 - 8 hrly
Cloxacillin	500 mg - 1 g 6 hrly	1 - 2 g 6 hrly
Doxycycline	100 mg 12 hrly	
Erythromycin	250 - 500 mg 6 hrly	1 g 6 hrly
Fluconazole	100 - 200 mg per day	100 - 200 mg per day
Flucytosine	37.5 mg/kg 6 hrly	
Fusidic acid	500 mg 8 hrly	500 mg 8 hrly
Gentamicin		1.5 - 2 mg/kg 8 hrly
Imipenem/Cilastatin		500 mg - 1 g 6hrly
Itraconazole	100 - 200 mg per day	
Kanamycin		5 - 7.5 mg/kg 8 hrly
Ketoconazole	200 - 400 mg 12 - 24 hrly	
Metronidazole	250 - 750 mg 8 hrly	500 mg 8 hrly
Nalidixic acid	1 g 6hrly	
Netilmicin		1.5 - 2 mg/kg 8 hrly

Nitrofurantoin	50 mg - 100 mg 6 - 8 hrly	
Norfloxacin	400 mg 12 hrly	
Nystatin	0.5 - 1 million units 6 hrly	
Ofloxacin	200 - 400 mg 12 hrly	
Pefloxacin	200 - 400 mg 12 hrly	
Penicillin G (Benzylpeniciilin)		1 - 4 mega 4 - 6 hrly
Procaine penicillin		0.6 - 1.2 mega 12 - 24 hrly
Benzathine penicillin		0.6 - 1.2 mega monthly
Penicillin V	250 - 500 mg 6 hrly	
Piperacillin		3 - 4 gm 4 - 6 hrly
Rifampicin	600 mg 24 hrly	600 mg 24 hrly
Tetracycline	250 - 500 mg 6 hrly	
Tobramycin		1.5 - 2 mg/kg 8hrly
Trimethoprim-sulphamethoxazole (Cotrimoxazole)	800 mg (based on sulphamethoxazole) or 2 tabs 12 hrly	
Vancomycin		250 - 500 mg 8 - 12 hrly

Aminoglycoside dosing : There is now evidence to show that once daily dosing is as effective as multiple dosing.

ANTIBIOTIC DOSAGES FOR NEONATES WITH SERIOUS INFECTIONS
Note : The following dosing guidelines are for intravenous administration.

Antibiotic	Full term neonate	Premature neonate
Amikacin	<7 days : 20mg/kg div. 12 hrly	15 mg/kg div. 12 hrly

	>7 days : 30 mg/kg div. 12 hrly	
Ampicillin	<7 days : 150 mg/kg div. 8hrly >7 days : 200 mg/kg div. 6 hrly	100 mg/kg div. 12 hrly
Cefotaxime	<7 days : 100 mg/kg div. 12 hrly >7 days : 150 mg/kg div. 8hrly	100 mg/kg div. 12 hrly
Ceftazidime	<7 days : 100 mg/kg div. 12 hrly >7 days : 150 mg/kg div. 8 hrly	100 mg/kg div. 12 hrly
Ceftriaxone	<15 days : 20-50 mg/kg once daily >15 days : 20-80 mg/kg once daily	<15 days : 20-50 mg/kg once daily >15 days : 20-80 mg/kg once daily
Chloramphenicol	<2 weeks : 25 mg/kg div. 8 hrly >2 weeks : 50 mg/kg div. 8 hrly	25 mg/kg div. 8hrly
Clindamycin	20 mg/kg div. 8 hrly	15 mg/kg div. 8 hrly
Cloxacillin	<10 days : 200 mg/kg div. 8 hrly >10 days : 200 mg/kg div. 6 hrly	<10 days (<2.5 kg) : 100 mg/kg div. 8hrly; >10 days (<2.5 kg) : 100 mg/kg div. 8 hrly
Gentamicin	<7 days : 5 mg/kg div. 12 hrly >7 days : 7.5 mg/kg div. 8 hrly	5 mg/kg div. 8 hrly
Imipenem	<7 days : 40 mg/kg div. 12 hrly >7 days : 60 mg/kg div. 8 hrly	40 mg/kg div. 12 hrly
Kanamycin	<7 days : 20 mg/kg div. 12 hrly >7 days : 30 mg/kg div. 8 hrly	<3 days : 10 mg/kg once daily >3 days : 20 mg/kg div. 12 hrly

Metronidazole	15 mg/kg loading dose, then 15 mg/kg div 12 hrly	
Netilmicin	<7 days : 5 mg/kg div. 12 hrly >7 days : 7.5 mg/kg div. 8 hrly	5 mg/kg div. 8 hrly
Penicillin G (Benzylpeniciilin)	<7 days : 250,000 U/kg div. 8 hrly >7 days : 400,000 U/kg div. 6 hrly	250,000 U/kg div. 12 hrly
Tobramycin	<7 days : 5 mg/kg div. 12 hrly >7 days : 7.5 mg/kg div. 8 hrly	5 mg/kg div. 8 hrly
Vancomycin	<7 days : 30 mg/kg div. 12 hrly >7 days : 45 mg/kg div. 8 hrly	30 mg/kg div. 12 hrly

ANTIBIOTIC DOSAGES OF ORAL ANTIBIOTICS FOR NEONATES

Antibiotic	Daily dosage
Amoxycillin	20-40 mg/kg div. 8 hrly
Ampicillin	50-100 mg/kg div 8 hrly
Cephalexin	50 mg/kg div 6 hrly
Chloramphenicol	< 14 days : 25 mg/kg div 8 hrly > 14 days : 50 mg/kg div. 6 hrly
Clindamycin	20 mg/kg div. 6 hrly
Cloxacillin	> 2.5 kg : 50-100 mg/kg div. 6 hrly < 2.5 kg : 50 mg/kg div. 8 hrly
Erythromycin	< 7 days : 20 mg/kg div. 12 hrly > 7 days : 20-40 mg/kg div. 6 hrly
Metronidazole	25 mg/kg div. 12 hrly

Penicillin V	50,000 U/kg div. 8 hrly

PARENTERAL ANTIBIOTIC DOSAGES FOR SERIOUS INFECTIONS IN INFANTS AND CHILDREN

Antibiotic	Daily dosage
Aminoglycosides Amikacin Gentamicin Kanamycin Netilmicin Streptomycin Tobramycin	22 mg/kg div. 8 hrly 7.5 mg/kg div. 8 hrly 30 mg/kg div. 8 hrly 7.5 mg/kg div. 8 hrly 20 mg/kg div. 12 hrly 5 mg/kg div. 8 hrly
Cephalosporins Cefoperazone Cefotaxime Ceftazidime Ceftriaxone	> 12 years : 150 mg/kg div. 8 hrly 200 mg/kg div. 6 hrly 150 mg/kg div. 8 hrly 100 mg/kg once daily
Chloramphenicol	100 mg/kg div. 6 hrly
Clindamycin	40 mg/kg div. 6 hrly
Erythromycin	40 mg/kg div. 6 hrly
Imipenem	40-60 mg/kg div. 6 hrly
Metronidazole	30 mg/kg div 6 hrly
Penicillins Penicillin G Benzathine penicillin Procaine penicillin Ampicillin Cloxacillin Piperacillin	400,000 U/kg div. 6 hrly 50,000 U/kg single dose im. 50,000 U/kg div. 12 hrly im. 200 mg/kg div. 6 hrly 200 mg/kg div. 6 hrly 200 - 300 mg/kg div. 6 hrly
Rifampicin	10 - 20 mg/kg div. 12 hrly
Trimethoprim-sulphamethoxazole (Cotrimoxazole)	20 mg TMP/100 mg SMX/kg div. 6 hrly
Vancomycin	40 mg/kg div. 6 hrly

ANTIBIOTIC DOSAGES OF ORAL ANTIBIOTICS FOR INFANTS AND CHILDREN

Antibiotic	Daily dosage
Azithromycin	10 mg/kg dly
Cephalosporins Cefuroxime Cephalexin Cefaclor Cefadroxil Cephradine	30 mg/kg div 12 hrly 25 - 50 mg/kg div. 6 hrly 20 - 50 mg/kg div 8 hrly 30 mg/kg div 12 hrly 25 - 50 mg/kg div 12 hrly
Chloramphenicol	50-100 mg/kg div. 6 hrly
Clindamycin	25 mg/kg div. 6 hrly
Macrolides Clarithromycin Erythromycin	15 mg/kg div. 12 hrly 25 - 50 mg/kg div. 6 hrly
Metronidazole	25 mg/kg div 6 hrly
Nalidixic acid	50 mg/kg div 6 hrly
Nitrofurantoin	7 mg/kg div 6 hrly 2 mg/kg single dose dly (prophylaxis)
Penicillins Penicillin V Amoxycillin Ampicillin Cloxacillin Amoxycillin-clavulate Sultamicillin	<10kg : 125 mg 8 hrly; >10 kg : 250 mg 8 hrly 20 - 40 mg/kg div. 8 hrly 50 - 100 mg/kg div. 6 hrly 50 - 100 mg/kg div. 6 hrly 20 - 40 mg/kg div. 8 hrly 25 - 50 mk/kg div 12 hrly
Rifampicin	20 mg/kg div. 12 hrly
Trimethoprim-sulphamethoxazole (Cotrimoxazole)	6-20 mg TMP/30-100 mg SMX/kg div. 12 hrly