**RATIONAL USE OF ANTIBIOTICS**

**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.   
 

**ANTIBIOTIC GUIDELINES 1996**

**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, scarlet fever**   **(***Streptococcus pyogenes* suspected or proven) | Penicillin V | Erythromycin | The majority of sore throats are viral in 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 pneumonia - severe**   (*Streptococcus pneumoniae, Hae-mophilus influenzae, Staphylococcus aureus, Klebsiella pneumoniae*) | Benzylpenicillin   or   Ampicillin   or   Erythromycin               Benzylpenicillin and   Gentamicin   or   2o or 3o Cephalo-sporin | Betalactam/   betalacta-mase inhibitor combination | Erythromycin is preferred when *Mycoplasma* is suspected.                        When *Staph aureus* is suspected or demonstrated 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 aerobic gram negative bacilli)  **immunosuppressed**   **(**aerobic gram negative bacilli and *Staphylo-coccus aureus* | Benzylpenicillin and   Gentamicin      3o Cephalo-sporin and   Gentamicin   Vancomycin   Gentamicin    and    a 3o Cepha-losporin  Gentamicin    and    a 3o Cephaloporin   or    Ureido-penicillin or   Carbapenem |  | If vancomycin is not available a combination of fucidin and rifampicin may be used                     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, streptococci and *Haem influenzae*** | Cloxacillin | Fusidic acid | For children < 5 yr use a combination of cloxacillin and 2o/ 3o Ceph-alosporin |
| **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, Enterococcus* and *Bacteroides*) | Penicillin and gentamicin    3o Cephalo-sporin    2o/3o cephalo-sporin and methronida-zole | 3o Ceph-alosporin      Gentamicin    Gentamicin   and   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)     **Trichomonal**   **(***Trichomonas vaginalis*)  **Bacterial vaginosis**   **(***Gardnerella vaginalis, Mobiluncus, Bacteroides* sp) | Nystatin   or   Clotrimazole    Metronida-zole   or Tinidazole   Metronida-zole   or   Tinidazole | Fluconazole   or Ketoconazole   or Itraconazole         Ampicillin | **Metronidazole should be avoided during the first trimester.**     **With recurrent infections consider treatment for the sexual partner as well.** |
| **Gonorrhoea**   (*Neisseria gonorrhoeae)*   Uncomplicated urethritis, rectal and pharyngeal gonorrhoea        **Pelvic inflammatory disease**     **Adult gonococcal ophthalmia**       **Gonococcal ophthalmia neonatorum** | Spectino-mycin   or   Ceftriaxone   or   Ciprofloxacin    Spectino-mycin   or   2o or 3o Cephalo-sporin   Ceftriaxone   or   Spectino-mycin |  | **For uncomplicated urethritis, rectal and pharyngeal gonorrhoea single dose treatment is sufficient.**       **For other forms of gonorrhoea, three day courses are required.**         **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)  **Brain abscess (children)**   (Staphylococci, streptococci, gram negative aerobic bacilli and anaerobic organisms) | Benzylpenicillin   and   Metronidazole   Cloxacillin   and   3o cephalo-sporin   and   Metronidazole | 3o Cephalo-sporin   and   Metronidazole | Surgical drainange is the definitive 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,* anaerobic organisms) | Gentamicin   and   Metronida-zole | 2o or 3o generation Cephalo-sporin   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**      **For patients who have prosthetic valves or previous endocarditis undergoing dental and upper respiratory procedures; and for patients undergoing genitourinary manipulation**    **For patients with prosthetic valves undergoing cardiac catheterisation, pace-maker insertion and skin biopsy** | Amoxycillin 3 g oral 1 hour before procedure   or   Ampicillin 1 g iv just before pro-cedure followed by 500 mg 6 hrs later  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   Cloxacillin 1 g iv and   Gentamicin 1.5 mg/kg iv   just before procedure |  | **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    **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 |
| **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, aerobic gram-negative bacilli) | 2o or 3o cephalosporin | 1. Gentamicin and Metronidazole   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   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 | Mitral valve prolapse with regurgitation   Pure mitral stenosis   Tricuspid valve disease   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 | Mitral valve prolapse without regurgitation   Trivial valvular regurgitation on 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   >7 days : 30 mg/kg div. 12 hrly | 15 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 |