NATIONAL ANTIBIOTIC GUIDELINE 2008

MINISTRY OF HEALTH MALAYSIA

NATIONAL ANTIBIOTIC GUIDELINE 2008

MESSAGE FROM THE DIRECTOR GENERAL OF HEALTH, MALAYSIA

From the 2007 audit on utilisation of 13 antibiotic injections in 15 major hospitals, it was found that the most used antibiotic was the cephalosporin group. Of particular concern was the consistent increase in the use of Cefoperazone-Sulbactam combination by nearly 30% each year for the past 2 consecutive years although we know that this antibiotic should only be reserved for treating multiresistant organisms. Similarly, the use of 3 other major groups of antibiotics namely the Carbapenems, Quinolones and Vancomycin showed steady increases by 50%, 38% and 30% respectively as compared to 2005. This increase in the trend of use cannot be taken lightly and measures must be taken to ensure that they are prescribed appropriately. In terms of expenditure, it was noted that hospitals spent between 5-15 percent of their annual drug budget on antibiotics alone.

Strategies such as good infection control practices, conduct of multidisciplinary antibiotic rounds, establishment of national antimicrobial guideline, surveillance programmes, audits, continuous training and education amongst health personnel are necessary and vital to promote and ensure the quality use of antibiotics. Inappropriate use of antibiotics as we all know is a major factor contributing to the development of resistance. Information on the trends and pattern of use is essential towards formulating control measures on antibiotic prescribing.

This revised National Antibiotic Guideline, I am sure, will be a useful and important guide for prescribers towards making appropriate antibiotic choices but local sensitivity patterns, particularly in tertiary hospitals, should also be taken into consideration where necessary. If local guidelines are developed, then the Hospital Infection Control and Antibiotic Committee must initiate regular audits to check for any non-compliance and misuse.

I would like to congratulate all specialists including heads of discipline and pharmacists who have contributed to the publication of this guideline. Special thanks also go to the external reviewers for their input and comments. Lastly, I must commend the editorial committee for successfully putting everything together to make it as comprehensive as possible. I am sure this is not an easy task. The next important step is to ensure that all relevant healthcare personnel gain access to this publication for easy reference.

Thank you

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CONTENT

INTRODUCTION TO THE GUIDELINES

Global and National Threat

The World Health Organization (WHO) in its document on Containment of Antimicrobial Resistance urges governments and the medical profession throughout the world to take active and concrete measures to address this threat. The rates of multiresistant organisms have increased significantly and, in a relatively short period of time in many countries. Methicillin Resistant *Staphylococcus aureus* (MRSA) and Extended Spectrum Beta-lactamase (ESBL) producing organisms like *Klebsiella pneumoniae* are now major adversaries in many of our local hospitals especially in the critical care settings. Broad spectrum antibiotics like the carbapenems, which once were very effective for most gram negative organisms are now experiencing up to 20% resistance in *Pseudomonas aeroginosa.*

What is driving Antibiotic Resistance?

The belief that antibiotic use or misuse is a major driving force for antibiotic resistance is now an established and recognised fact. It is thus imperative for all healthcare practitioners to play their role in combating this threat so as to preserve the effectiveness and the relevance of current antibiotics in our practice. Rational antibiotic use must be viewed as a skill that all medical practitioners must acquire so as to ensure effective, safe and appropriate patient care. Appropriate treatment in our current approach is not only about using an antibiotic that the organism is sensitive to but also includes the use of one that will have minimal collateral damage to the ambient bacterial flora.

National Antibiotic Guideline 2008

The last national antibiotic guideline for the Ministry of Health was published in 1997; an which was a collaborative effort with the Academy of Medicine. With new clinical information and challenges over the last decade, it is certainly time for developing a new document to provide guidance in the use of antimicrobials in common infections encountered in the Ministry of Health clinical facilities.

This document is a collaborative effort involving a large number of specialists from within the Ministry of Health; spanning all major clinical disciplines and bringing together the expertise and experience of many senior clinicians from all regions of the country. The recommendations are based on *current clinical evidence* similar to the approach taken in the production of clinical practice guidelines, the *current list of antimicrobials in the ministry drug formulary*, the *pattern of antimicrobial resistance seen in the country* as well as the *current practice within Ministry of Health hospitals.*

Nonetheless because of the large spectrum of clinical infections; some of which involved several disciplines, consensus decision-making involving the relevant stakeholders was pursued whenever differences of opinion occurred. While the editorial committee aimed to address all common infections in the numerous clinical settings within the ministry, they also took due cognizance of the need to keep the document concise for the purpose of producing a pocket handbook. Hence, the editorial committee decided to include only the more common and critical infections for mention. Less common infections and those seen only in specialised areas, regrettably, had to be omitted. Most portions of the document are formatted in a standardised manner so as to provide uniformity and to make it more reader friendly.

Antibiotic choices are classified into preferred and alternative recommendations based on clinical evidence of effectiveness, adverse effects, potential of collateral damage as well as cost and access. References have been inserted whenever possible.

This document aims to guide clinicians in their empirical choice of antimicrobial agents; balancing the need to get the right choice from the outset and the necessity to contain antimicrobial misuse so as to preserve future treatment options especially in the current era of growing antimicrobial resistance. Nonetheless, this document merely acts as a guide and each case must still be accessed according to its own merits.

Appreciation
On behalf of the editorial committee and the secretariat, I would like to thank the numerous contributors from all clinical disciplines, all heads of discipline, infectious diseases specialists, microbiologists and pharmacists who have directly or indirectly assisted in this document. I would also like to thank our external reviewers for their invaluable input. Their commitment and patience in this endeavor is much appreciated. We would also like to convey our gratitude to Tan Sri Datuk Dr Hj. Mohd Ismail Merican, the Director-General of Health for all his support and advice.

Dr Christopher K.C. Lee
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Ministry of Health
14th December 2007

PRINCIPLES OF ANTIBIOTIC THERAPY AND RATIONAL ANTIBIOTIC PRESCRIBING

Infections remain a common cause of presentation to the outpatient department and inpatient admissions to the hospital. Antibiotics are widely being prescribed to treat infections, both in the community and hospital setting. Selection of appropriate anti-infective therapy can be challenging to the clinician. Consequently, understanding the basic principles of antiinfective therapy is important to ensure optimal outcome and to reduce selective pressure on antibiotics, which may be associated with the development of antibiotic resistance. The overuse and misuse of antibiotics have contributed to increased bacterial resistance to antibiotics, among other contributory factors. Antibiotics are frequently prescribed for indications in which their use is not warranted, or an inappropriate or suboptimal antibiotic is prescribed. The available evidence suggests that, when antibiotic use is warranted, choosing the therapy most likely to achieve clinical cure and treating for the shortest length of time to achieve clinical and microbiological efficacy will result in a lower incidence of retreatment and lower incidence of antibiotic resistance. The rational use of medicines has been defined by the WHO as requiring that patients receive medications appropriate to their clinical needs, in doses that meet their own requirements, for an adequate time, and at the lowest cost to them and their community.

A thorough clinical assessment of the patient is imperative to ascertain the underlying disease process, and if it is an infection, to predict the pathogens associated with the infection and select an antibiotic that will target the likely organisms. Where appropriate and clinically indicated, the initial assessment should be supported by relevant laboratory investigations to establish a definitive microbiological diagnosis and to determine the susceptibility of the organism to various antibiotics. The routine use of antibiotics to treat fever is inappropriate, as not all fever is caused by infection and antibiotics are only indicated for bacterial infections. Antibiotics should not be prescribed when bacterial infections are unlikely, such as for common cold, coughs and bronchitis, as irrational antibiotic prescribing is documented as one of the main factors that encourage emergence of antibiotic-resistant pathogens.

When choosing an antibiotic for empirical treatment of an infection, the following factors are important to assist and guide the decision making process:

Is there an indication for an antimicrobial agent?

Indications for an antibiotic include the unambiguous demonstration or the strong suspicion that the etiologic agent is bacterial. This should be based on the signs and symptoms of infection, as well as on other factors, including the age of the patient, the patient's medical history, and the presence or absence of comorbidities.

What are the most common organisms causing the infection and the local antibiotic susceptibility pattern?

Knowledge of the likely organisms causing a particular infection and the local susceptibility profile are useful to select the antibiotic. For example, erysipelas is caused primarily by *Streptococcus pyogenes* which is usually sensitive to penicillins and macrolides, while impetigo may be caused by Streptococcus pyogenes or *Staphylococcus aureus, both sensitive to penicillase-resistant penicillins such as cloxacillin.*

What is the antibiotic spectrum of the chosen empirical agent?

The antibiotic spectrum refers to the range of microorganisms an antibiotic is usually effective against and is an important consideration for empiric therapy. Decision on choice of antibiotic based on the spectrum of coverage should be made based on severity of illness, pathogen probabilities (whether gram-positive or gram-negative bacteria), local resistance patterns, comorbid conditions and recent antibiotic exposure. The definitive choice of antibiotics should be made after review of culture and susceptibility results and therapy should be tailored accordingly.

What are the known pharmacokinetics and pharmacodynamics that are associated with a particular antibiotic?

Knowledge of the pharmacokinetics and pharmacodynamic principles assist the clinician in predicting the clinical and microbiologic success of antibiotic treatment. Concentration-dependent bacterial killing is a feature of antibiotics such as aminoglycosides and fluoroquinolones, higher concentrations resulting in more rapid killing. Time-dependent bacterial killing is associated with beta-lactam antibiotics, greater degree of bacterial killing occurring when the time of exposure is above the minimal inhibitory concentration of the pathogen.

What host factors might affect antibiotic selection and dosing?

Host factors, such as patient age and underlying disease, are important considerations in selecting appropriate antibiotic therapy for suspected bacterial infections. Host factors influence the types of bacteria likely to be pathogenic and organ failures may impact on dosing regimens and predispose to adverse drug reactions.

What is the cost-effectiveness of the antibiotic selection?

Choosing inappropriate therapy is associated with increased costs, including the cost of the antibiotic and increases in overall costs of medical care because of treatment failures and adverse events. Using an optimal course of antibiotics can have economic as well as clinical advantages, including a faster return to normal daily routine and earlier return to work.

What are the antibiotic adverse reactions?

Antibiotic prescribing may be associated with potential side effects that may affect the relative risks and benefits of therapy. All antibiotics have potential side effects, and it is important for the clinician to be aware of how these might affect the patient.

What is the optimal duration of treatment?

There are very few infections for which the duration of treatment has been precisely defined. This reflects the fact that the end-points for assessing treatment are largely clinical rather than microbiological. Clinical features that are driven by the inflammatory response usually subside after microbial elimination. Clinicians should assess the time frame for discontinuing antibiotics after careful review of the clinical response, guided by microbiological clearance of the pathogen whenever appropriate.

In conclusion, antibiotic prescribing should be made after careful consideration of the underlying infective process, the likely etiologic agents, local susceptibility pattern, known spectrum of a chosen antibiotic, host factors and comorbidities. Rational antibiotic prescribing can minimize development of antibiotic resistance and reduce costs of healthcare.

What is de-escalation therapy and when is it warranted?

De-escalation of antibiotic therapy refers to short-term, broad-spectrum antibiotic coverage followed by changes to more narrow focused regimens that are driven by culture and other laboratory results. This limited use does not expose the patient to the potential adverse effects of untreated serious infections or to the complications associated with long-term broad-spectrum antibiotic use, which are primarily the emergence of resistant organisms or new infections. This approach is particularly pertinent when dealing with life-threatening conditions especially infections in the critical care patients, immunocompromised patients and patients with risk factors for hospital acquired infections; where delay in initiating the appropriate antibiotic therapy may result in mortality. Broad-spectrum initial therapy does not appear to result in the emergence of antibiotic resistance as long as the duration of use was limited. The choice of the initial antibiotic regimen should be based on the local microbiological surveillance data.

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SECTION A: ADULTS

CARDIOVASCULAR INFECTIONS

A. INFECTIVE ENDOCARDITIS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Empirical Treatment			
	Benzylpenicillin 24 mega units/24h IV either continuously or in 4-6 equally divided doses **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h If there is a strong possibility of staphylococcal infection, e.g. IV drug abuse, infected haemodialysis lines or pacemaker infection: Cloxacillin 12g/24h IV in 4-6 divided doses **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h		Treatment can be modified once the blood result is known

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Viridans Streptococci & Streptococcus Bovis It is recommended MIC estimation is done for these isolates to facilitate management			
Native Valves **MIC: ≤ 0.12µg/mL** *Penicillin-Susceptible Viridans Streptococci & Streptococcus Bovis*	Benzylpenicillin 12-18 mega units/24h IV either continuously or in 4-6 equally divided doses for 4 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 4 weeks **OR** Benzylpenicillin 12-18 mega units/24h IV either continuously or in 4-6 equally divided doses for 2 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 2 weeks **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 2 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 2 weeks	4-weeks regimen preferred for patients > 65 years or patients with impaired renal or 8th cranial nerve function 2-weeks regimen not intended for patients with ◆ known cardiac or extracardiac abscess ◆ creatinine clearance <20ml/min ◆ impaired 8th nerve function

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Native Valves **MIC: > 0.12µg/mL- ≤ 0.5µg/mL** *Penicillin-Relatively Resistant Viridans Streptococci & Streptococcus Bovis*	Benzylpenicillin 24 mega units/24h IV either continuously or in 4-6 equally divided doses for 4 weeks **PLUS** Gentamicin[1] 3mg/kg IM/IV q24h for 2 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 4 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 2 weeks If unable to tolerate Penicillin/Ceftriaxone: Vancomycin[1] 15mg/kg IV q12h for 4 weeks, not to exceed 2g/24h (unless serum levels are monitored)	
Native Valves **MIC > 0.5µg/mL** *Penicillin-resistant Viridans Streptococci & Streptococcus Bovis*	Treat as enterococcal endocarditis - see below **		
Prosthetic Valves **MIC < 0.12µg/mL** *Penicillin-Susceptible Viridans Streptococci & Streptococcus Bovis*	Benzylpenicillin 24 mega units/24h IV either continuously or in 4-6 equally divided doses for 6 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 2 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 6 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 2 weeks If unable to tolerate Penicillin/Ceftriaxone: Vancomycin[1] 15mg/kg IV q12h for 6 weeks, not to exceed 2g/24h (unless serum levels are monitored)	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Prosthetic Valves **MIC > 0.12µg/mL** *Penicillin-relatively resistant or fully resistant Viridans Streptococci & Streptococcus Bovis*	Benzylpenicillin 24 mega units/24h IV either continuously or in in 4-6 equally divided doses for 6 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 6 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 6 weeks **PLUS** Gentamicin[1] 3mg/kg IV/IM q24h for 6 weeks If unable to tolerate Penicillin/ Ceftriaxone: Vancomycin[1] 15mg/kg IV q12h for 6 weeks, not to exceed 2g/24h (unless serum levels are monitored)	
** **Enterococcus** *(It is recommended that all these isolates are tested for high level resistance (HLR) to Gentamicin)*			
Native and Prosthetic Valves *Enterococcal Endocarditis sensitive to Gentamicin*	Ampicillin 2g IV q4h for 4-6 weeks **PLUS** *Gentamicin[1] 1mg/kg IM/IV q8h for 4-6 weeks	Benzylpenicillin 18-30 mega units/24h IV in 4-6 equally divided doses for 4-6 weeks **PLUS** *Gentamicin[1] 1mg/kg IM/IV q8h for 4-6 weeks If unable to tolerate Penicillin: Vancomycin[1] 15mg/kg IV q12h for 6 weeks, not to exceed 2g/24h (unless serum levels are monitored) **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h for 6 weeks	Native valve: Symptoms < 3 months - 4 weeks therapy Symptoms > 3 months - 6 weeks therapy Prosthetic valve: minimum 6 weeks **In order to maximise synergistic effect, administer Gentamicin at the same time or temporally close to Ampicillin/Penicillin* For Enterococcal Endocarditis with high level resistance to Gentamicin, consult Infectious Disease Specialist

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Staphylococcus Aureus			
Native Valves *Methicillin-Susceptible Staphylococci*	Left sided endocarditis and complicated right sided (see comments): Cloxacillin 12g/24h IV in 4-6 divided doses for 6 weeks **PLUS/MINUS** Gentamicin[1] 1mg/kg IV/IM q8h for 3-5 days Right sided endocarditis (tricuspid valve) in uncomplicated endocarditis (see comments): Cloxacillin 12g/24h IV in 4-6 divided doses for 2 weeks **PLUS** Gentamicin[1]1mg/kg IM/IV q8h for 2 weeks	Regimen for β-lactam allergic patients: <u>Immediate type hypersensitivity to penicillin (anaphylaxis):</u> Vancomycin[1] 15mg/kg IV q12h for 6 weeks, not to exceed 2g/24h (unless serum levels are monitored) <u>For non-immediate type hypersensitivity:</u> * Cefazolin 2g IV q8h for 6 weeks **PLUS/MINUS** Gentamicin[1] 1mg/kg IM/IV q8h for 3-5 days	Uncomplicated right sided endocarditis: Absence of renal failure, extra pulmonary metastatic infections such as osteomyelitis, aortic or mitral valve involvement, meningitis, or infection by MRSA * If Cefazolin is not available, use of Cefuroxime may be considered

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Prosthetic Valves *Methicillin-Susceptible Staphylococci*	Cloxacillin 12g/24h IV in 4-6 divided doses for ≥ 6 weeks **PLUS** Rifampicin[2] 300mg PO q8h for ≥ 6 weeks **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h for 2 weeks	Regimen for β-lactam allergic patients: Immediate type hypersensitivity to Penicillin (anaphylaxis): Vancomycin[1] 15mg/kg IV q12h for ≥ 6 weeks, not to exceed 2g/24h (unless serum levels are monitored) **PLUS** Rifampicin[2] 300mg PO q8h for ≥ 6 weeks **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h for 2 weeks For non-immediate type hypersensitivity: *Cefazolin 2g IV q8h for 6 weeks **PLUS** Rifampicin[2] 300mg PO q8h for ≥ 6 weeks **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h for 2 weeks	*If Cefazolin is not available, use of Cefuroxime may be considered

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Native Valves Methicillin-Resistant Staphylococci	Vancomycin[1] 15mg/kg IV q12h for 6 weeks, not to exceed 2g/24h (unless serum levels are monitored)		
Prosthetic Valves *MRSA*	Vancomycin[1] 15mg/kg IV q12h for ≥ 6 weeks, not to exceed 2g/24h (unless serum levels are monitored) **PLUS** Rifampicin[2] 300mg PO q8h for ≥ 6 weeks **PLUS** Gentamicin[1] 1mg/kg IM/IV q8h for 2 weeks		
HACEK Microorganisms *(Haemophilus parainfluenzae, Haemophilus aphrophilus, Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella kingae)*			
Native and Prosthetic valves	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV/IM q24h for 4 weeks	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 3g IV q6h for 4 weeks	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Therapy for Culture-Negative Endocarditis - Consultation with an infectious disease specialist needed			
Native Valves	Ampicillin/Sulbactam 3g IV q6h for 4-6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 4-6 weeks	Vancomycin[1] 15mg/kg IV q12h for 4-6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 4-6 weeks **PLUS** Ciprofloxacin 500mg PO q12h OR 400mg IV q12h for 4-6 weeks	Vancomycin recommended only for patients unable to tolerate penicillins
Prosthetic valve (early, <1 y)	Vancomycin[1] 15mg/kg IV q12h for 6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks **PLUS** Cefepime 2g IV q8h for 6 weeks **PLUS** Rifampicin 300mg PO/IV q8h for 6 weeks		
Prosthetic valve (late, >1 y)	Ampicillin/Sulbactam 3g IV q6h for 4-6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 4-6 weeks **PLUS** Rifampicin 300mg PO/IV q8h for 6 weeks		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Suspected Bartonella, culture negative	Ceftriaxone 2g IV/IM q24h for 6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks **OR** Doxycycline 100mg IV/PO q12h for 6 weeks		Patients with Bartonella endocarditis should be treated in consultation with an infectious disease specialist
Documented Bartonella, culture positive	Doxycycline 100mg IV/PO q12h **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks	If Gentamicin cannot be given, then replace with Rifampicin 600mg PO/IV q24h in 2 equally divided doses	

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)
[2]Rifampicin plays a unique role in the eradication of staphylococcal infection involving prosthetic material, combination therapy is essential to prevent emergence of rifampicin resistance

B. TREATMENT OF PACEMAKER INFECTIONS

Antibiotic	Duration	Comments
While awaiting microbiological diagnosis provide empirical cover for MRSA with: Vancomycin 15mg/kg IV q12h not to exceed 2g/24h (unless serum levels are monitored) ◆ Infection of pulse generator pocket with blood stream infection ◆ Lead associated endocarditis Change antibiotics according to culture results	 10 to 14 days 6 weeks	*Complete removal of the entire implanted system including the cardiac leads is recommended even in patients with clinical infection of the pocket only* *The new implant can be placed on the contra lateral side 10 to 14 days after the removal of the implanted system in patients with infection of the pulse generator pocket and as late as 6 weeks in those with endocarditis*

Reference: American Heart Association Guideline 2005

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Meningitis (acute)			
Common organisms: *Streptococcus pneumoniae* *Neisseria meningitidis* *Haemophilus influenzae* **Other organisms:** Gram negative rods Leptospirosis Scrub typhus Melioidosis *Mycoplasma pneumoniae*	**Empirical treatment on admission:** Benzylpenicillin 4 mega units IV q4-6h **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 50-100mg/kg/24h IV in 2 divided doses (max: 4g/day). Usual dose is 2g q12h **OR** Cefotaxime 200mg/kg/24h IV in 3 divided doses (max: 12g/day). Usual dose is 2g q8h	Meropenem 120mg/kg/24h IV in 3 divided doses (max: 6g/day) Usual dose is 0.5-1.0g q8h Change to Meropenem if patient showed no clinical response after 3 days of antibiotics IV Dexamethasone in a dose of 0.15mg/kg (10mg) q6h is recommended to be administered 15 to 20 minutes before or at the time of first dose of antibiotics, for up to 4 days or until there is no evidence of pneumococcal meningitis	Antibiotic treatment must be started immediately, regardless of any investigations undertaken. If no organism isolated and patient is responding, continue antibiotics for 7-10 days Meropenem has slightly increased activity against gram negative organisms and slightly decreased activity against staphylococci and streptococci compared to imipenem Reference: - Harrison's principles of Internal Medicine, 18th. Edition - de Gans J, van de Beek D. Dexamethasone in adults with bacterial meningitis. N Engl J Med 2002; 347:1549-1556

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Causative organism isolated:			
Haemophilus influenzae *(Gram -ve bacilli)*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 50-100mg/kg/24h IV in 2 divided doses (max: 4g/day). Usual dose is 2g q12h **OR** Cefotaxime 200mg/kg/24h IV in 3 divided doses (max: 12g/day). Usual dose in 2g q8h Duration of treatment: 7-10 days	Meropenem 120mg/kg/24h IV in 3 divided doses (max: 6g/day). Usual dose is 0.5-1g q8h ***If organism is susceptible:*** Chloramphenicol 1g IV q6h for 14 days (max: 4g/day)	Increasing primary resistance of *Haemophillus influenzae* to Chloramphenicol and Ampicillin - in HKL 7.7% and 23.1% respectively
Streptococcus pneumoniae *(Gram +ve cocci)*	**Penicillin-sensitive strains** Benzylpenicillin 4 mega units IV q4-6h for 10-14 days **Relatively-resistant strains** *3rd gen. Cephalosporins, e.g.* Ceftriaxone IV OR Cefotaxime IV for 10-14 days, at doses for *H. influenzae* Duration of treatment: 10-14 days Very ill patients may require treatment for 21 days	Vancomycin[1] 1g IV q12h **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone IV or Cefotaxime IV (For penicillin and cephalosporins resistant strains)	Resistance to penicillin in community acquired *Streptococcus pneumoniae* in HKL is 16.9%

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Neisseria meningitides (Gram -ve cocci)	Benzylpenicillin 4 mega units IV q4-6h for 7-10 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone IV OR Cefotaxime IV at doses for *H. influenzae*	For patients who do not have adequate response to penicillin, the treatment should be changed to 3rd gen. Cephalosporins, e.g. Ceftriaxone OR Cefotaxime
Prophylaxis for household and close contacts	Rifampicin 600mg PO q12h for 2 days (4 doses) [not recommended in pregnant women] **OR** Ciprofloxacin 500mg PO as single dose	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 250mg IM as single dose (especially in pregnancy) **OR** Azithromycin 500mg PO as single dose	Close contacts are defined as those individuals who have had contact with oropharyngeal secretions either through kissing or by sharing toys, beverages, or cigarettes
Viral encephalitis *Herpes simplex* *Herpes zoster*	Acyclovir 5mg/kg IV q8h for 10-14 days Acyclovir 10mg/kg IV q8h for 10-14 days		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Meningitis (Chronic)			
Tuberculous meningitis *Mycobacterium tuberculosis*	Intensive 2 months treatment: Isoniazid 5-10mg/kg/24h PO [300mg] **PLUS** Pyridoxine 20-60mg PO q24h **PLUS** Rifampicin 10mg/kg/24h PO [600mg] **PLUS** Pyrazinamide 15-30mg/kg/24h PO [1.5-2g] **PLUS** Streptomycin 15-20mg/kg/24h IM [0.75-1g] **OR** Ethambutol 15-20mg/kg/24h PO [800mg] Refer to Page 143 (Tuberculosis Infections) Infection in HIV patients - refer to Page 53 (Human Immunodeficiency Virus)	Refer to Page 143 (Tuberculosis Infections) for management of tuberculosis for **drug resistant tuberculosis**	Treatment is continued for 12 months Medium dose steroid cover for MRC stage 2 and 3 patients: *Dexamethasone 4mg q8h for 2 weeks and then taper down within 4 weeks, or oral prednisolone 30-40mg/24h in tapering doses for 4-6 weeks*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Cryptococcal Meningitis *Cryptococcus neoformans*	Amphotericin B 0.3-0.6mg/kg/24h IV until total dose of at least 1-1.5g **PLUS** Fluconazole 400mg PO q24h for 10-12 weeks For fulminant cases: 1st month - Amphotericin B at 0.3-0.6mg/kg/24h IV **PLUS** 5-Flucytosine 100-150mg/kg/24h IV/PO in 4 divided doses Followed by 2 months of Amphotericin B IV [same dose] + Fluconazole 400mg PO q24h *Infection in HIV patients* - Refer to Page 53 (Human Immunodeficiency Virus)	Fluconazole 400mg IV q24h initially and then 200-400mg IV q24h for 6-8 weeks Fluconazole "consolidation" therapy may be continued for as long as 6-12 months, depending on the clinical status of the patient **If fluconazole is not tolerated:** Itraconazole 200mg PO q12h	End point of treatment: till at least 1.5-2.0g of Amphotericin B given and CSF shows clearance of fungus by 2 negative C&S one month apart, and CSF Cryptococcal antigen titre becomes negative or at least 1:2 or shows a fourfold decrease Liposomal Amphotericin may be used in cases of severe toxicity to Amphotericin B e.g. *Abelcet 3-5mg/kg/day *Requires DG approval Reference: Infect Med 1998; 15(6): 396-409
Neurosyphilis	Refer to Page 100 (Sexually Transmitted Infections)		
HIV related CNS infection	Refer to Page 53 (Human Immunodeficiency Virus)		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

Reference: Use of Antibiotics in Adults: CPG Guidelines. Ministry of Health, Singapore, 2006
IDSA Practice Guidelines for Management of Cryptococcal Disease, CID 2000; 30:710-718

CHEMOPROPHYLAXIS

A. Surgical Chemoprophylaxis

It is the use of antibiotics to prevent infections at the surgical site. It should be considered when there is significant risk of post-operative infection or where post-operative infection would have severe consequences. Ideally the prophylaxis when given intravenously should be given as soon as the patient is stabilised after induction. Usually a single dose is sufficient. A second dose may be required in the following situations:

a. delay in start of surgery
b. in prolonged operations when the time is more than half of the usual dosing interval of the antibiotic

Giving more than 1 or 2 doses postoperatively is generally not advised. The practice of continuing prophylactic antibiotics until surgical drains have been removed is not RECOMMENDED

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. OBSTETRICS			
C-Section a. Elective b. Emergency	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV to be given 10 minutes before the first incision	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 1.5g IV **OR** Cefoperazone 1g IV In complicated LSCS (with bowel &/or bladder involvement or possibility of chorioamnionitis): **ADD** Metronidazole 500mg IV	RCOG Guidelines Antibiotics should be given for at least 5-7 days duration

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Peri/Postpartum Hysterectomy	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 1.5g IV **OR** Cefoperazone 1g IV **PLUS** Metronidazole 500mg IV	Antibiotics should be given for 5-7 days
Repair of Vaginal/Birth tract trauma e.g. third and fourth degree tears	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 1.5g IV **OR** Cefoperazone 1g IV **PLUS** Metronidazole 500mg IV Antibiotics should be given for at least 5-7 days duration		RCOG Guideline
2. GYNAECOLOGY			
Elective Surgery - TAH/TAHBSO - Vaginal hysterectomy *Coliforms, Enterococcus, Streptococcus, Clostridia and Bacteroides* sp	Cefuroxime 1.5g IV	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5-3g IV 30-45 minutes before induction	Second dose if procedure > 3 hours
Emergency Laparotomy	Cefuroxime 1.5g IV	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g **OR** Amoxycillin/Clavulanate 1.2g	ACOG Recommendations: If bowel or bladder perforation occurs add Metronidazole

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
3. ORAL SURGERY			
Indication:			
Elective Minor Oral Surgery	Not Indicated		Prophylaxis is recommended for all patients with an increased risk of surgical wound infection - i.e. in immunocompromised patients
Elective Major Oral Surgery	Indicated		
Which Antibiotic / Route of Administration / Dose / Timing / Duration			
	* Benzylpenicillin IV 1st Dose: 2 mega units IV (just before procedure) Subsequent Doses: 1 mega unit IV q3h (do not extend beyond surgery) **PLUS** ** Cloxacillin IV (if surgery involves skin) 1st Dose: 1g PO/IV Subsequent Doses: 500mg PO/IV (do not extend beyond surgery) **If Penicillin Contraindicated** *** Clindamycin IV 1st Dose*: 300mg IV (just before procedure) Subsequent Doses: 150mg IV q3h (do not extend beyond surgery)	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate IV 1st Dose: 1.2g IV (just before procedure) Subsequent Doses: 0.6g IV q4h (do not extend beyond surgery) **OR** Cefuroxime IV 1st Dose: 1.5g (just before procedure) Subsequent Doses: 750mg IV q4h (do not extend beyond surgery) **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone IV (if all other above antibiotics contraindicated) 1g just before procedure (do not extend beyond surgery)	***Benzylpenicillin IV** should be given by **slow intravenous injection or by infusion** ****Cloxacillin IV should be given by slow intravenous injection or by infusion** *****Clindamycin IV should be given in 50ml of diluent over 10 min**

- Doses listed are adult doses - for paediatric patients adjust according to age/body weight
- References from KKM CPG: Antibiotic Prophylaxis against Wound Infections for Oral Surgical Procedures 2003 (Reviewed 2007)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
4. PLASTIC SURGERY			
Lip repair, Palatoplasty/ Pharyngoplasty	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV	Erythromycin 500mg IV	Skin, oral and nasal pathogen
Craniofacial surgery Maxillofacial surgery	Metronidazole 500mg IV **PLUS** *2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 1.5g IV **OR** Ceftriaxone 2g IV (if craniotomy required)	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV	Skin, oral and nasal pathogen Prophylaxis against meningitis/encephalitis
Head and neck tumour	Metronidazole 500mg IV **PLUS** Cefuroxime 1.5g IV	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV	Skin, oral and nasal pathogen
Facial injuries	Cloxacillin 500mg-1g IV	Cefuroxime 1.5g IV *β-lactam/β-lactamase inhibitors, e.g.*	Gross contamination Skin pathogen
Breast surgery reconstructive	Cefuroxime 1.5g IV	Ampicillin/Sulbactam 1.5g IV	Skin pathogen
Hand replantation	Cefuroxime 1.5g IV	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV	Gross contamination Skin pathogen Prophylaxis against tenosynovitis

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
5. VASCULAR SURGERY			
All Vascular Operations	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV **OR** Cefazolin 1g IV **OR** Cloxacillin 1g IV	Cefuroxime 1.5g IV	In clean cases e.g aneurysectomy the antibiotic is given for 24 hours only. In cases where there is an infective foci, continue antibiotic as treatment
Implantation of prosthetic grafts in patients at risk to MRSA infection	Vancomycin[1] 500mg IV		In patients at risk, including patients on hemodialysis and long staying in-patients as well as units that have an MRSA outbreak; this is usually given for 24 hours
Burns	Cloxacillin 1g IV	Cefuroxime 1.5g IV	Debridement Monitor C&S

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
6. HEPATOBILIARY SURGERY			
Open Cholecystectomy ERCP ± stent	Cefuroxime 1.5g IV OR *3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV **OR** Amoxycillin/Clavulanate 1.2g IV	Antibiotic prophylaxis NOT recommended for laparoscopic cholecystectomy
7. GENERAL SURGERY			
Upper GIT oesophagus, stomach & upper small bowel	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** *3rd gen. Cephalosporins, e.g.* Cefotaxime, Cefoperazone 1g IV		
Distal small bowel Colo-rectal	Cefuroxime 1.5g IV **PLUS** Metronidazole 500mg IV	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV **PLUS** Metronidazole 500mg IV; **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV	
Hernia repair with mesh	Cloxacillin 1g IV	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV	Includes laparoscopic repair

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Breast	Cloxacillin 1g IV	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV	Not recommended for minor excisions
8. ORTHOPAEDIC SURGERY			
Internal fixation of all closed fracture Total Joint Replacement	Cloxacillin 1g IV	Cefuroxime 1.5g IV pre-operation, continue 750mg IV q8h (3 doses) post-operation; **OR** Cefazolin 1-2g IV	30-45 minutes before skin incision and before tourniquet inflation
Spine surgery			
Arthroscopy			
Gunshot and other penetrating wounds *Staphylococcus Clostridium species*	Cloxacillin 1g IV **OR** 2nd gen. Cephalosporins **PLUS** Metronidazole 500mg IV	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV	Thorough surgical debridement
Muscular, skeletal and soft tissue trauma, crush injuries and stab wounds	Cloxacillin 1-2g q6h **PLUS** Gentamicin[1] 1.5mg/kg IV q8h **PLUS** Metronidazole 500mg slow IV q8h Duration: Should not be less than 5 days	If possible renal impairment: Cefuroxime 1.5g IV as a loading dose followed by 750mg IV q8h **PLUS** Metronidazole 500mg slow IV q8h Duration: Should not be less than 5 days	In all cases, a patient's tetanus immunisation status should be assessed

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Compound fractures	Cloxacillin 1g IV q6h If wound soiling or tissue damage is severe and/or devitalised tissue is present: **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Metronidazole 500mg slow IV q8h	Cefuroxime 1.5g IV as a loading dose, followed by 750mg IV q8h	In all cases, a patient's tetanus immunisation status should be assessed Duration *(based on the grade of fracture):* Grade 1: 2 weeks Grade 2: 2-4 weeks Grade 3: 2-6 weeks
9. UROLOGICAL SURGERY			
A. Diagnostic Procedures			
Transrectal ultrasound and prostate biopsy *E coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Ciprofloxacin 500mg PO q12h	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h	5 days (pre-emptive therapy) Oral antibiotics to start 1 day before procedure
Cystoscopy/Urodynamics study/ Retrograde pyelogram/Ureteric stenting	None	None	Prophylaxis only for - ***High risk cases*** (immunocompromised patients e.g. debilitated patients on long term catheters, patient with prosthesis/heart valves, diabetics, transplant recipients) - If heart valve: ❖ follow recommendation for SBE prophylaxis - Other patients: ❖ Cefuroxime 250mg PO stat

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
B. Endourology			
Endourological surgery *e.g. PCNL, URS, RIRS, TURP* *E coli, Klebsiella, Proteus,Enterococcus, Pseudomonas*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Ampicillin/Sulbactam 1.5g IV	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV	
C. Open Surgery			
Clean operations e.g. orchidectomy, orchidopexy, varicocelectomy, deroofing renal cysts *Staph aureus*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV stat **OR** Ampicillin/Sulbactam 1.5g IV stat	Cefuroxime 750mg IV stat	
Clean-contaminated (with opening of urinary tract) *e.g. nephrectomy, prostatectomy, open stone surgery.* *E coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h for 1 day	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h for 1 day	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Clean-contaminated (with use of bowel segments) e.g. *Cystectomy with urinary diversion, cystoplasty.* *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas, Anaerobes*	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h **PLUS** Metronidazole 500mg IV q8h	Gentamicin[1] 1.5mg/kg IV q8h **PLUS** Metronidazole 500mg IV q8h	For duration of catheter presence
Implant of prosthetic devices e.g. Insertion of penile prosthesis or artificial urinary sphincter, artificial slings *Staph aureus*	Cefuroxime 1.5g IV q8h for 1 week	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h for 1 week	Pre-emptive therapy
Laparoscopic surgery	As for open surgery	As for open surgery	Depending on type of procedure performed whether clean or clean - contaminated
Reference: European Association of Urology Guidelines 2006			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
10. NEUROLOGICAL SURGERY			
Clean, non-implant surgery (procedure does not cross the cranial sinuses) e.g. Tumour excision, evacuation of intracerebral clots *Staphylococcus aureus* Gram-positive cocci Gram-negative bacilli	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV stat at induction of anaesthesia and q6h during surgery	Cefuroxime 1.5g IV at induction of anaesthesia and q3h during surgery	
Clean-contaminated surgery (procedure crosses the cranial sinuses) e.g. Transphenoidal surgery	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV **PLUS** Metronidazole 500mg IV at induction of anaesthesia and q3h during surgery	Cefuroxime 1.5g IV **PLUS** Metronidazole 500mg IV at induction of anaesthesia and q3h during surgery	
CSF shunt surgery *Coagulase - Negative Staphylococcus spp Staphylococcus aureus* *Aerobic gram-ve bacilli* (Aerobic gram-ve bacilli are late infections)	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Cefuroxime 1.5g IV	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
11. GASTROENTEROLOGY			
ERCP ANTIBIOTIC PROPHYLAXIS			
- Bile stasis - Pancreatic Pseudocyst - Previous Cholangitis	*3rd gen. Cephalosporins, e.g.* Cefotaxime 2g IV 30 minutes before procedure	Gentamicin[1] 120mg IV just before procedure **OR** Ciprofloxacin 750mg PO 60-90 minutes before procedure	Prompt and adequate biliary drainage is essential in biliary obstruction
PERCUTANEOUS ENDOSCOPIC GASTROSTOMY (PEG)			
PEG PEJ*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV **OR** Cefuroxime 1.5g IV given 30 minutes before procedure	*3rd gen. Cephalosporins, e.g.* Cefotaxime 2g IV 30 minutes before procedure	* Percutaneous endoscopic Jejunostomy Reference: *Am J Gastro 95:3133, 2000*
UPPER GI BLEEDING IN CIRRHOSIS (Antibiotic Prophylaxis)			
Upper GI bleeding in cirrhosis	Ciprofloxacin 500mg PO q12h **OR** 200mg IV q12h for 7 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV q24h for 7 days **OR** Cefotaxime 2g IV q8h for 7 days	Should be offered to all cirrhotics with upper GI bleeding Reference: *Cochrane database 2002(2): CD002907*
Reference: British Society of Gastroenterology			

12. OPHTHALMOLOGY
Use of povidone iodine 5% as an antiseptic agent for preparation of skin and conjunctival sac preoperatively is recommended
Proper draping of the eyelid margin using an adhesive non porous drape and the use of speculum to cover all the eyelashes is recommended
Intracameral injection of 1mg Cefuroxime in 0.1ml at the end of cataract surgery is recommended. Careful dilution should be undertaken to prevent potential toxicity
Reference: Prophylaxis for intraocular surgery-CPG for Management of Post-Operative Endophthalmitis, Ministry of Health Malaysia, August 2006

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

B. Non-Surgical Chemoprophylaxis

1. PREVENTION OF BACTERIAL ENDOCARDITIS

(a) Cardiac conditions for which prophylaxis is recommended

High risk category

- Prosthetic cardiac valves, including bioprosthetic and homograft valves
- Previous bacterial endocarditis
- Complex cyanotic congenital heart disease (e.g. single ventricle states, transposition of the great arteries, Tetralogy of Fallot)
- Surgically constructed systemic pulmonary shunts or conduits

Moderate risk category

- Most other congenital cardiac malformations (other than above & below)
- Acquired valvular dysfunction (e.g. rheumatic heart disease)
- Hypertrophic cardiomyopathy
- Mitral valve prolapse with valvular regurgitation and/or thickened leaflets

(b) Dental Procedures for which prophylaxis is recommended

- Dental Extractions
- Periodontal procedures including surgery, scaling and root planing, probing and recall maintenance
- Dental implant placement and reimplantation of avulsed teeth
- Endodontic (root canal) instrumentation or surgery only beyond the apex
- Subgingival placement of antibiotic fibers or strips
- Initial placement of orthodontic bands but not brackets
- Intraligamentary local anaesthetic injections
- Prophylactic cleaning of teeth or implants where bleeding is anticipated

(c) Other Procedures for which prophylaxis is recommended

Respiratory Tract

- Tonsillectomy and/or adenoidectomy
- Surgical operations that involve respiratory mucosa
- Bronchoscopy with a rigid bronchoscope

Gastrointestinal Tract

- Sclerotherapy for esophageal varices
- Esophageal stricture dilation
- Endoscopic retrograde cholangiography with biliary obstruction
- Biliary tract surgery
- Surgical operations that involve intestinal mucosa

Genitourinary Tract

- Prosthetic surgery
- Cytoscopy
- Urethral dilation

PROPHYLACTIC REGIMENS FOR DENTAL, ORAL RESPIRATORY TRACT OR OESOPHAGEAL PROCEDURES

Situation	Agents	Regimens
Standard General Prophylaxis	Amoxycillin	2g PO 1h prior to procedure
Unable to take oral medications	Ampicillin	2g IM/IV within 30min prior to procedure
Allergic to penicillin	Clindamycin	600mg PO 1h prior to procedure
	Cephalexin	2g PO 1h prior to procedure
	Azithromycin OR Clarithromycin	500mg PO 1h prior to procedure
Allergic to penicillin and unable to take oral medication	Cefazolin/ Ceftriaxone	1g IM/IV within 30min prior to procedure
	OR	
	Clindamycin	600mg IV within 30min prior to procedure

Note:
1. Cephalosporins should not be used in individuals with immediate type hypersensitivity reaction (urticaria, angioedema, or anaphylaxis) to penicillins
2. For established respiratory infection, if Staphylococcus is suspected, give prophylactic regimes containing anti-staphylococcal penicillins or cephalosporins or Vancomycin[1] if unable to tolerate beta lactams

PROPHYLACTIC REGIMENS GENITOURINARY/GASTROINTESTINAL (EXCLUDING OESOPHAGEAL) PROCEDURES

Situation	Agents	Regimens
High risk patients	Ampicillin **PLUS** Gentamicin[1]	Ampicillin 2g IM/IV **PLUS** Gentamicin[1] 1.5mg/kg (not to exceed 120mg) within 30min prior to procedure **FOLLOWED BY** Ampicillin 1g IM/IV **OR** Amoxycillin 1g PO 6h later
High risk patients allergic to Ampicillin/ Amoxycillin	Vancomycin[1] **PLUS** Gentamicin[1]	Vancomycin[1] 1g IV over 1-2h **PLUS** Gentamicin[1] 1.5mg/kg IV/IM (not to exceed 120mg). Complete infusion within 30min of starting procedure
Moderate risk patients	Amoxycillin **OR** Ampicillin	Amoxycillin 2g PO 1h prior to procedure **OR** Ampicillin 2g IM/IV within 30min prior to procedure
Moderate risk patients allergic to Ampicillin/ Amoxycillin	Vancomycin[1]	Vancomycin[1] 1g IV over 1-2h complete infusion within 30min of starting procedure

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

Note: No second dose of Vancomycin or Gentamicin is recommended

2. RHEUMATIC FEVER

a) SECONDARY PREVENTION OF RHEUMATIC FEVER (Prevention of recurrent attacks)

Benzathine Penicillin 1.2 mega units IM every 4 weeks (in high risk situations give every 3 weeks) **OR**
Phenoxymethylpenicillin 250mg PO q12h

If allergic to Penicillin:

EES 400mg PO q12h

b) DURATION OF SECONDARY PREVENTION OF RHEUMATIC FEVER PROPHYLAXIS

Rheumatic fever with carditis and residual heart disease (persistant valvular disease - clinical or echocardiograph evidence)	At least 10 years since last episode and at least until age of 40 years, sometimes lifelong prophylaxis
Rheumatic fever with carditis but no residual heart disease (no valvular disease)	10 years or well into adulthood, whichever is longer
Rheumatic fever without carditis	5 years or until age 21 years, whichever is longer

3. RECOMMENDATIONS FOR PREVENTION OF INFECTION IN ASPLENIA (OR HYPOSPLENIA) ADULT PATIENTS

A. Antibiotics Prophylaxis

Antibiotics Prophylaxis	**1.** Phenoxymethylpenicillin 250-500mg PO q12h **OR** Amoxycillin 500mg PO q12h **2.** Penicillin allergy - EES 400mg PO q12h **OR** Azithromycin 250mg PO q24h **3.** Duration: Minimum 2 years post splenectomy is encouraged in adults. Up to 16 years of age in children. Life long is not recommended *(McMullin 1993). Long term management of patients after splenectomy. BMJ 307, 1372-1373* **4.** Emergency supply of antibiotic: ***Alternative to OR in addition to long term prophylaxis*** a) Amoxycillin 3g PO should be kept at home if fever occurs OR b) Cefuroxime 1g PO OR c) Amoxycillin/Clavulanate 625mg PO OR d) If taking EES, increase dose to 800mg PO q12h OR e) If taking Azithromycin, increase dose to 500mg PO q24h OR f) Clindamycin 600mg PO OR g) Trimethoprim/Sulphamethoxazole 960mg PO Take higher regime as stat dose and seek medical advice as soon as possible

Patient Education	Inform patient (and relative/friend) of increased risk of infection and strategies to prevent bacterial infections. Discuss OPSI (overwhelming post splenectomy infection), tick and animal bites/scratches. Provide immunisation card
Blood test	FBC and PBF-assessing presence of Howell Jolly bodies
Travel Recommendations	1. Seek medical advice before travel 2. Ensure meningococcal vaccination is current for travel to high incidence countries 3. Always carry the immunisation card
Alerts	Patient is encouraged to wear/carry medic alert medallion or wallet card
SEEK MEDICAL ATTENTION	Fever, shivers, vomiting, prolonged sore throat (signs of bacterial infection)

B. Vaccine

Vaccine Recommendation	Which vaccine	Route	Timing	Re-vaccination
Pneumococcal vaccine	Pneumococcal 23-valent polysaccharide vaccine (Pneumo 23)	0.5ml S/C or IM	> 2 weeks before elective surgery. 7-14 days after emergency splenectomy or prior to discharge	Booster every 5 years
Meningococcal vaccines *polysaccharide*	Meningococcal quadrivalent polysaccharide ACWY vaccine (Mencevax ACWY or Menomune)	0.5ml S/C	As above	Polysaccharide ACWY Booster every 5 years
Hemophilus influenzae type B	HiB (Liquid Pedvax HIB) Annually	0.5ml IM thigh/upper arm	As above	No booster required
Influenza		0.5ml deep S/C		Annual

For patient with bleeding disorder and there is concern about giving vaccinations, vaccinations are given subcutaneously including HiB vaccine. Any doubt please contact Haematology Registrar

GASTROINTESTINAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. OESOPHAGITIS			
a. Fungal Infections	Refer to Page 53 (Human Immunodeficiency Virus)	Acyclovir 400mg PO q8h for 7-10 days	Duration of therapy represents total time IV, PO, or IV + PO. Most patients on IV therapy able to take PO medications should be switched to PO therapy soon after clinical improvement (usually < 72 hours)
b. Viral *HSV-1*	Acyclovir 5mg/kg IV q8h for 7-10 days		
CMV	Ganciclovir 5mg/kg IV q12h for 3-6 weeks		
2. Helicobacter Pylori INFECTION *(Ref. P. Malfertheiner et al. GUT 2007; 56:772-781)*			
- Peptic ulcer disease (Including complicated PUD) - MALToma - Atrophic gastritis - After gastric cancer resection - Patient who are first-degree relatives of patients with gastric cancer - Non-ulcer dyspepsia - Naïve NSAID users - Chronic NSAID users - Long term aspirin use - Long term PPI therapy - Immune Thrombocytopenic Purpura and iron deficiency anaemia	*Proton Pump Inhibitors (PPI) e.g. Omeprazole, Pantoprazole, Lansoprazole, Rabeprazole, Esomeprazole PO q12h for 7 days **PLUS** Clarithromycin 500mg PO q12h for 7 days **PLUS** Metronidazole 400mg PO q12h for 7 days **OR** Amoxycillin 1g PO q12h for 7 days	PPI, e.g. Omeprazole 20mg PO q12h **PLUS** Amoxycillin 1g PO q12h **OR** Tetracycline 500mg PO q8h **PLUS** Metronidazole 400mg PO q8h for 10 days	- First choice therapy recommended in areas with <15-20% Clarithromycin resistance. - Bismuth-based quadruple therapy for 7-10 days may be used as second choice therapy if available. - Third choice or rescue treatment should be based on antibiotic susceptibility testing ** Dosages:-* *Omeprazole 20mg q12h* *Pantoprazole 40mg q12h* *Lansoprazole 30mg q12h* *Rabeprazole 20mg q12h* *Esomeprazole 20mg q12h*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
3. INFECTIOUS DIARRHOEA *(Reference: NEJM 342: 1716, 2000; JID 185: 133, 2002; CID 39: 504, 2004)*			
a. Acute Watery Diarrhoea Campylobacter Yersinia Salmonella Aeromonas Plesiomonas sp	Ciprofloxacin 500mg PO q12h for 3-5 days	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3-5 days	- Antibiotics are not indicated in acute or uncomplicated diarrhoea *(Oral Rehydration Solution will be sufficient)* - Antibiotics may be considered when patients have fever (>38.5°C) and severe diarrhoea in the elderly
b. Acute Dysentery *E. histolytica*	Metronidazole 800mg PO q8h for 10 days	Tinidazole 1g PO q12h for 3 days	
Shigella	Ciprofloxacin 200-400mg IV or 500mg PO q12h for 3 days	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3 days **OR** Azithromycin 500mg IV or PO q24h for 3 days	Fever and bloody stool are features of dysentery
c. Chronic Watery Diarrhoea *Giardia lamblia*	Metronidazole 400-800mg PO q8h for 5 days	Albendazole 400mg PO q24h for 5 days **OR** Tinidazole 2g stat	
Cryptosporidia	Treatment is unsatisfactory		
Cyclospora	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 7-10 days		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
d. Antibiotic-associated Diarrhoea *Clostridium difficile*			
Uncomplicated	Metronidazole 400mg PO q8h for 14 days	Vancomycin 125mg PO q6h for 14 days	- Discontinue offending antibiotic if possible. Avoid antimotility agents
Severe with ileus or toxic mega colon	Metronidazole 500mg IV q8h	Vancomycin 500mg PO q6h (via nasogastric tube)	- Rifampicin may be added to Vancomycin for relapsing disease
Relapsing disease	Metronidazole 400mg PO q8h for 10 days	Vancomycin PO tapering dose over 4 weeks or 125mg EOD for 6 weeks	- The IV preparation of Vancomycin may be taken orally if oral Vancomycin is not available
4. LIVER ABSCESS			
a. Pyogenic Liver Abscess			
Enterobacteriaceae *Enterococci* *Bacteroides*	Amipicillin 1-2g IV q6h **PLUS** Gentamicin[1] 1.5mg/kg IV q8h **PLUS** Metronidazole 500mg IV q8h for 14 days; **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5-3g IV q6h for 14 days	Metronidazole 500mg IV q8h **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h **OR** Ciprofloxacin 400mg IV q12h for 14 days	Treat until clinical improvement achieved Surgical or percutaneous drainage may be required Follow-up ultrasound scans recommended Metronidazole may be added to the regimen if an amoebic liver abscess cannot be excluded

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
b. Amoebic Liver Abscess *Entamoeba histolytica*	Metronidazole 500mg IV q8h for 10 days (May switch to PO when clinical improvement occurs)	Tinidazole 2g PO q24h for 3-5 days	
5. CHOLECYSTITIS *(Ref: M. Yoshida et al. J. Hepatobiliary Pancreat. Surg (2007) 14:83-90)*			
a. Mild *E. coli* *Klebsiella* *Enterococci*	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 3g IV q6h for 7 days **OR** Ciprofloxacin 500mg PO q12h for 7 days		Grade I (mild) acute cholecystitis is defined as acute cholecystitis in a patient with limited gallbladder disease, making cholecystectomy a low risk procedure
b. Moderate *E. coli* *Klebsiella* *Enterococci*	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 3g IV q6h for 7 days		Grade II (moderate) acute cholecystitis is associated with extensive gallbladder disease resulting in difficulty in safely performing a cholecystectomy

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
c. Severe *E. coli* *Klebsiella* *Enterococci*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12h for 7 days **PLUS** Metronidazole 500mg IV q8h for 7 days	Ciprofloxacin 400mg IV q12h for 7 days **PLUS** Metronidazole 500mg IV q8h for 7 days **OR** *Cefoperazone/Sulbactam 2g IV q12h for 7 days **PLUS** Metronidazole 500mg IV q8h for 7 days **OR** Imipenem 500mg IV q6h for 7 days **OR** Meropenem 1g IV q8h for 7 days	Grade III (severe) acute cholecystitis is defined as acute cholecystitis with organ dysfunction **Reserved for Acinetobacter*
6. CHOLANGITIS *(Refefence: A. Tanaka et al. J. Hepatobiliary Pancreat Surg (2007) 14:59-67)*			
Normal host *E. coli* *Klebsiella* *Enterococci*	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 3g IV q6h for 7 days **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h for 7 days **OR** Cefoperazone 2g IV q12h for 7 days **PLUS** Metronidazole 500mg IV q8h for 7 days	Ciprofloxacin 400mg IV q12h **PLUS** Metronidazole 500mg IV q8h for 7 days **OR** Imipenem 500mg IV q6h for 7 days **OR** Piperacillin/Tazobactam 4.5g IV q8h for 7 days *(If Pseudomonas)*	Duration of treatment is a minimum of 7 days Antimicrobial therapy should be selected according to the severity assessment Empirical agents should be changed according to bile C&S reports Biliary drainage should be performed for moderate to severe cholangitis

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
7. ACUTE PANCREATITIS (ANTIBIOTIC PROPHYLAXIS) *(Ref: UK guidelines for the management of Acute Pancreatitis GUT 2005; 54:1-9)*			
Severe acute pancreatitis (CT evidence of >30% necrosis)	Imipenem 500mg IV q6h for 7-14 days		The evidence for antibiotic prophylaxis in severe acute pancreatitis is conflicting. There is currently no clear consensus
8. PANCREATIC INFECTIONS *(Am J Gastroenterol 2006; 101:2379-2400)*			
Infected pancreatic necrosis *Entereobacteriaceae* *B. fragilis* Pancreatic abscess Infected Pseudocyst	Ciprofloxacin 400mg IV q12h **PLUS** Metronidazole 500mg IV q8h for 14 days	Imipenem 500mg IV q6h for 14 days **OR** Meropenem 1g IV q8h for 14 days **OR** Piperacillin/Tazobactam 4.5g IV q8h for 14 days	CT-guided percutaneous aspiration with Gram's stain and culture is recommended when infected necrosis is suspected Culture of Abscess, infected pseudocyst or infected necrosis should guide treatment Drainage of the abscess and/or surgery may be required

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
9. DIVERTICULAR DISEASE *(Ref: World Gastroenterology Organization (WGO) Practice Guidelines)*			
Diverticulitis *E. coli* *B. fragilis*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h for 7days **OR** Ciprofloxacin 200-400mg IV q12h **PLUS** Metronidazole 500mg IV q8h for 7days		If there is no improvement in 48-72 hours, look for complications e.g. abscess and perforation
10. INTRA-ABDOMINAL INFECTIONS/PERITONITIS *(Reference: Clin Infection. Dec. 2003; 37:997-1005)*			
Spontaneous bacterial peritonitis (SBP)‡ *Entereobacteriaceae* *For other on Intra-abdominal Infections/peritonitis - Refer to Page 120 (Surgical Infections)*	*3rd gen. Cephalosporins, e.g.* Cefotaxime 2g IV q8h for 5 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h for 5 days	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
11. HEPATOSPLENIC CANDIDIASIS			
Hepato-splenic candidiasis *Candida albicans*	Fluconazole 400mg IV/PO q24h for 21 days (or at least 2 weeks after being culture negative)	Amphotericin B 0.5mg/kg IV q24h for 21 days	

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

A. HAEMATOLOGY

1. Any infection in the immunocompromised host is life-threatening and needs immediate attention. Neutropaenic sepsis is defined as a temperature of > 38.3°C or > 38°C over one hour and ANC < 500 cells/uL or < 1000 cells/uL in those with anticipated declining counts.

2. Cultures may be positive in less than 40% of cases. Patients have impaired inflammatory responses and hence may have no localizing signs. The usual sign is fever > 38°C or hypothermia. Empirical antibiotics must be started immediately after appropriate blood cultures are taken. The common portals of infection include the oral cavity, gastrointestinal tract, perianal region, lungs and IV lines.

3. Potential pathogens are dependent on the underlying defect, e.g.

Neutropaenia	Gm -ve organisms Gm +ve organisms Fungi
Hypogammaglobulinaemia	Encapsulated organisms
Defective cellular immunity	Pneumocystis, Toxoplasma Fungi Viruses Mycobacteria

4. The choice of antibiotics is based on local organisms and sensitivity patterns. This should depend on sound clinical judgement, the clinical state of the patient, prior infections, recent outbreaks e.g. MRSA or multiresistant Klebsiella, E coli as well as the availability and cost of the antibiotics. The incidence of ESBL-producing organisms in the local setting must be borne in mind when selecting agents for use in the first line setting. Many less virulent or uncommon organisms are also increasingly seen e.g. *Stenotrophomonas maltophilia*, *Acinetobacter spp.*

5. For neutropaenic adult patient, the following regimens are suggested:

   a. **1st line** Piperacillin/Tazobactam 4.5g IV q6h **OR** Cefepime 2g IV q8h. Aminoglycosides e.g Gentamicin or Amikacin may be added in combination therapy.

   b. **2nd line** Carbapenem: Imipenem 500mg IV q8h/q6h **OR** Meropenem 1g q8h. Imipenem 1g q8h is used in severe sepsis.

   c. **Monotherapy** is likely just as efficacious and less toxic. Drugs that can be used as monotherapy are Piperacillin/Tazobactam, Cefepime, Imipenem or Meropenem.

   d. **Anaerobic infections** account for < 5% of all cases of bactaeraemia. Piperacillin/Tazobactam and Carbapenems generally have good anaerobic coverage. Metronidazole 500mg IV q8h may be added in the presence of severe mucositis, intraabdominal infections, perirectal abscesses or colitis.

e. **Glycopeptide therapy** e.g. Vancomycin **OR** Teicoplanin can be delayed 48-72h without risk. Vancomycin 15mg/kg IV q12h or q8h may be added in suspected central device infections, known colonizers by MRSA, severe mucositis, suspected MRSA/MRSE infections and severe sepsis, septic shock or respiratory distress. Linezolid is an alternative in those patients with no clinical response to Vancomycin and in those with VRE, VISA or VRSA.

f. **Antifungal therapy** is added from day 5 to 7 or earlier especially for severe mucositis, thrush, painful swallowing, suspicious skin infiltrates or pulmonary infiltrates, fundal exudates or after prolonged steroid/antibiotic use > 2 weeks. Amphotericin B remains the empirical therapy of choice for invasive fungal treatments. For patients who are intolerant, refractory or those with toxicity, the lipid formulations and Caspofungin are alternative as empirical therapy. Voriconazole is an alternative to Amphotericin B for the treatment of invasive aspergillosis.

g. **The use of growth factors** e.g. G-CSF or GM-CSF may be considered but the benefits in this setting have not been proven. It should be considered in high-risk patients with ANC < 100/uL, MODS, pneumonia, invasive fungal infections or septic shock.

h. **The use of immunoglobulins** and IgM enriched preparations has not shown survival benefits in adult patients with sepsis.

i. **The role of granulocytes** remains controversial. Granulocyte transfusions may be used in patients with serious bacterial or fungal infections not responding to appropriate treatment and who will likely recover in the neutrophil count in the short term. The risk of disease transmission e.g. CMV must be borne in mind.

j. **The use of oral antibiotics** in an outpatient setting for low risk patients is currently not advised as the risks stratification have not been validated in a local setting, the local resistance patterns of organisms to the oral therapy e.g. Ciprofloxacin and Amoxycillin/Clavulanate as well as the lack of local facilities for immediate access to prompt medical attention in the outpatient.

k. **Prophylaxis against bacterial or fungal infections** is advised after bone marrow transplantation or in the high-risk patient after chemotherapy. In the routine setting, it results in increasing resistance and is expensive.

l. Infections following stem cell transplant are generally similar to that in the solid organ transplant setting. In addition to the usual bacterial and fungal infections, viral infections especially CMV reactivation and parasitic infections e.g. Pneumocystis carinii and Toxoplasma infection can occur. It is recommended that prophylactic use of Ganciclovir or preemptive monitoring for CMV reactivation should be carried out during the first 100 days. Trimethoprim/Sulphamethoxazole 6-8 tablets per week is also extremely effective in the prevention of PCP or toxoplasmosis. It is recommended that these measures be continued in patients with active graft-vs-host disease and in those remaining on high dose immunosuppressives.

1st line	Piperacillin/Tazobactam 4.5g IV q6h **OR** Cefepime 2g IV q8h	Aminoglycosides e.g. Gentamicin or Amikacin may be added in combination
2nd line	Imipenem 500mg IV q8h or q6h or 1g q8h (severe sepsis) **OR** Meropenem 1g q8h	
Glycopeptides	Vancomycin 15mg/kg IV q12h or q8h	May be delayed 48-72h until cultures, unless indicated
Antifungal agents	Conventional Amphotericin B Liposomal Amphotericn B Caspofungin	May be added as empirical therapy from D5-7 Voriconazole preferred in invasive aspergillosis

6. Attention must be paid to:
   a. Strict isolation measures
   b. Patient's personal hygiene and diet
   c. Modification of antibiotic regimen if deterioration of clinical status or if there is no clinical improvement in 72-96h in a stable patient
   d. The antibiotics are generally kept for a minimal duration of 5 to 7 days or stopped if afebrile for 3 days in patients with improving neutrophil counts
   e. Regular culture and surveillance
   f. HAND WASHING and strict aseptic technique
   g. Venous canula must be inspected daily for signs of phlebitis and changed every 72h or when necessary. Central devices are removed if there is clinical deterioration in spite of appropriate antibiotics for 48-72h

References:

1. NCCN Clinical Practice Guidelines in Oncology V.I 2006. Fever and Neutropaenia
2. Hughes WT, Armstrong D, Bodey GP et al. 2002 Guidelines for the use of antimicrobial agents in neutropenic patients with cancer. Clin Infect Dis 2002; 34:730-751
3. Herbrect R, Denning DW, Patterson TF et al. Voriconazole versus amphotericn B for primary therapy of invasive aspergillosis. NEJM 2002; 347:408-415
4. Walsh TJ, Teppler H, Donowitz GR et al. Caspofungin versus liposomal amphotericin B for empirical antifungal therapy in patients with persistent fever and neutropaenia. NEJM 2004; 351(14):1391-1402

B. Human Immunodeficiency Virus (HIV)

Important cut-offs for CD4 T cells, above which particular AIDS illnesses are improbable.
These CD4 counts are only reference values; exceptions are always possible.

No cut-off	Kaposi's sarcoma, pulmonary tuberculosis, HZV, bacterial pneumonia, lymphoma
< 250/μl	PCP, esophageal candidiasis, PML, HSV
< 100/μl	Cerebral toxoplasmosis, HIV encephalopathy, cryptococcosis, miliary tuberculosis
< 50/μl	CMV retinitis, cryptosporidiosis, atypical mycobacteriosis

The treatment regimes are based on drugs available in the Ministry of Health National Formulary and hence in some instances may vary from internationally accepted treatments. Some regimes are chosen as preferred regimes due to cost considerations

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Pneumocystic Jiroveci (Carinii)			
Interstitial Pneumonia	Trimethoprim 15-20mg/kg/24h **PLUS** Sulfamethoxazole 75-100mg/kg/24h PO (excellent bioavailability) or IV q6h or q8h for 21 days	**For severe cases:** **(PO_2 < 70mmHg)** Pentamidine 4mg/kg/24h IV (in 1 pint D5% or N/S run over 1-2 hours) **For mild to moderate cases:** **(PO_2 70-80mmHg)** Clindamycin 600mg IV q8h OR 300-450mg PO q6h **PLUS** Primaquine 30mg base PO/24h for 21 days **OR** Dapsone 100mg PO q24h **PLUS** Trimethoprim 15mg/kg/day PO (3 divided doses)	Patients with severe disease should receive steroids as soon as possible (within 72 hours of starting PCP treatment): Prednisolone 40mg PO q12h for 5 days then 40mg PO q24h for 5 days then 20mg PO q24h for 11 days

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Prophylaxis Indications: H/o PCP, CD4 < 200 or <14% HIV associated thrush, or unexplained fever > 2 weeks	Trimethoprim/Sulfamethoxazole 160/800mg q24h **OR** 80/400mg q24h	Dapsone 100mg PO q24h Aerosolized Pentamidine 300mg monthly via Respiguard II nebulizer or ultrasonic nebulizer $\pm O_2$ agonist	Patients given Dapsone should be tested for G6-PD deficiency if at risk **Discontinuation:** Consider in patients on HAART with CD4 > 200 for > 3-6 months **Secondary prophylaxis:** Should be re-introduced if the CD4+ T lymphocyte count decreases to < 200 cells/μL **OR** if PCP recurs at a CD4+T lymphocyte count of > 200
Candidal			
Oropharyngeal (thrush)	Itraconazole 200mg PO q24h **OR** Nystatin suspension 400,000-600,000 units (4-6ml) q6h for 7-14 days	Fluconazole 100mg PO q24h	Suppressive therapy - generally not recommended unless patients have frequent or severe recurrences
Vaginitis	Azoles pessary (Clotrimazole, Miconazole) for 3-7 days	Fluconazole 150mg PO x 1 dose **OR** Itraconazole 200mg PO q12h for 1 day or 200mg PO q24h for 3 days	Prolonged or refractory episodes is observed in approximately 10% of patients and requires antimycotic therapy for >7 days

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Esophagitis	Fluconazole 200mg PO q24h up to 400mg q24h for 2 weeks	Itraconazole 200mg PO q12h **OR** Amphotericin B 0.3-0.7mg/kg IV q24h	Candidiasis is the most common cause of esophagitis with HIV infection, but CMV, HSV and aphthous ulcerations can present with similar complaints Endoscopy required with unusual presentations or lack of response to azole within several days
Cryptococcal meningitis or meningoencephalitis (by Cryptococcus neoformans var neoformans)			
Initial Treatment	Induction therapy: Amphotericin B 0.7mg/kg/24h **PLUS/MINUS** Flucytosine 25mg/kg PO q6h for 2 weeks Consolidation therapy: Fluconazole 400mg PO q24h for 8 weeks or until CSF cultures are sterile	Induction therapy: Fluconazole 400-800mg q24h PO **PLUS** Flucytosine 25mg/kg PO q6h for 4-6 weeks Consolidation therapy: Itraconazole 200mg PO q12h	If ICP >250mm and signs of cerebral oedema present, do daily LP to reduce pressure until patient is improved If clinical signs of cerebral oedema do not improve after about 2 weeks of daily LPs, consider placement of a lumbar drain or ventriculoperitoneal shunt
Maintenance Therapy	Fluconazole 200mg PO q24h	Itraconazole 200mg PO q24h for patients intolerant or failed Fluconazole	**Discontinuation:** Consider if patient on HAART with good viral suppression and CD4>200 >6 months

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Toxoplasma Gondii Encephalitis			
Acute Infection (up to 97% patients are Toxo IgG +ve)	*Pyrimethamine 100-200mg PO loading dose followed by Pyrimethamine 50-100mg PO q24h (Fansidar 1 tab q12h) **PLUS** Folinic acid 10-25mg PO q24h **PLUS** Clindamycin 600mg IV/PO q6h for at least 6 weeks	*Pyrimethamine **PLUS** Folinic acid (see preferred regime) **PLUS** Sulfadiazine 1g PO q6h **OR** Trimethoprim/Sulfamethoxazole (5mg/kg TMP and 25mg/kg SMX) IV or PO q12h	*1 tab Fansidar (Sulfadoxine/ Pyrimethamine) contains 25mg of pyrimethamine **Adjunctive corticosteroids** (e.g. dexamethasone) should be administered when clinically indicated only for treatment of a mass effect associated with focal lesions or associated edema. Because of the potential immunosuppressive effects of corticosteroids, they should be discontinued as soon as clinically feasible
Suppressive/ Maintenance Therapy	Pyrimethamine 25-75mg PO q24h **PLUS** Clindamycin 300-450mg PO q6-8h **PLUS** Folinic acid 10-25mg q24h	Pyrimethamine 25-75mg PO q24h **PLUS** Folinic acid 10-25mg q24h **PLUS** Sulphadiazine 0.5-1g PO q24h	**Discontinuation:** Consider when on HAART, CD4 > 200 > 3 months and viral load well suppressed

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1⁰ Prophylaxis Indications: ToxoIgG +ve and CD4<100	Trimethoprim/Sulfamethoxazole 160/800mg PO q24h	Trimethoprim/Sulfamethoxazole 80/400mg PO q24h **OR** Dapsone 50mg/day PO **PLUS** Pyrimethamine 50mg/week PO **PLUS** Folinic acid 25mg/week PO **OR** Dapsone 200mg/week PO **PLUS** Pyrimethamine 75mg/week PO **PLUS** Folinic Acid 25mg/week PO	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Mycobacterium Avium Complex Disease			
Treatment	Clarithromycin 500mg PO q12h **PLUS** Ethambutol 15mg/kg/24h PO	Azithromycin 500-1000mg/24h PO **PLUS** Ethambutol (same dose) Alternate 3rd or 4th drug **PLUS** Amikacin1 10-15mg/kg/24h IV **OR** Ciprofloxacin 500-750mg PO q12h **OR** Levofloxacin 500mg PO q24h	**Discontinuation:** Consider if patient is on HAART and viral load well suppressed, CD4 > 100 > 6 months, asymptomatic of MAC, and has completed > 12 months of MAC treatment Caution with Clarithromycin **PLUS** Efavirenz: high rates of rash
1⁰ Prophylaxis Indications: CD4 < 50 cells Ruled out MAC bacteremia and active TB	Clarithromycin 500mg PO q12h **OR** Azithromycin 1.2g weekly		
Cytomegalovirus Retinitis			
Initial Therapy (until scar formation on the lesion)	Ganciclovir 5mg/kg IV q12h for 2-3 weeks Maintenance Regime: Intravitreal Ganciclovir 400µg/week	Alternative maintenance: Ganciclovir 5mg/kg IV q24h	Initial therapy should also include optimisation of HAART

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Extraocular CMV diseases: Esophageal ulcer, colitis Interstitial pneumonitis	Ganciclovir 5mg/kg IV q12h for 21-28 days or until signs and symptoms have been resolved		Maintenance therapy is generally not necessary; HAART offers best hope for prevention of relapses
Salmonella (non-typhi)			
Initial Therapy	Salmonella gastroenteritis: Ciprofloxacin 500-750mg PO q12h OR 400mg IV q12h **Duration:** - Mild gastroenteritis without bacteremia = 7-14 days - Advanced HIV (CD4+ <200) and/or bacteremia = at least 4-6 weeks	Trimethoprim/Sulfamethoxazole PO **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone IV **OR** Cefotaxime IV	
Maintenance Therapy	Trimethoprim/Sulfamethoxazole 160/800 PO q12h		**Discontinuation:** Consider once patient on HAART, viral load well suppressed and CD4 > 200 > 6 months

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Herpes Simplex			
	Genital or orolabial herpes: Acyclovir 400mg PO q8h OR 800mg PO q12h for 5-10 days Moderate-to-severe mucocutaneous HSV infections: Initial therapy - Acyclovir 5mg/kg IV q8h After lesion begins to regress, Acyclovir 400mg PO q8h until lesions have completely healed Suppressive therapy: Acyclovir 400mg PO q12h		Suppressive therapy indicated if herpes outbreaks frequent or severe
Herpes Zoster			
Initial Therapy	Acyclovir 800mg PO 5x/day for 7-10 days Severe infection (CNS, ocular, disseminated): Acyclovir 10mg/kg IV q8h for 14-21 days		Effective in immune competent patients only if initiated within 72h, but for immune suppressed, treat unless lesions crusted Consider treatment for severe infection whenever clinical diagnosis of zoster likely + altered mental status or visual symptoms while definitive diagnosis pursued

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Histoplasmosis			
Initial Therapy	Induction regime: Amphotericin B 0.6-0.7mg/kg IV q24h for 2 weeks Continuation phase: (12 weeks) Itraconazole 200mg PO q12h Chronic maintenance therapy: Itraconazole 200mg PO q24h	In less severe disease: Itraconazole 200mg PO q8h for 3 days, then 200mg PO q12h for 12 weeks	Consider discontinuation among patients who remain asymptomatic, with CD4+ count > 100-200 cells/μL for > 6months Syrup Itraconazole has better bioavailability and hence preferred by some for the induction phase in less severe disease
Isospora Belli Infection			
Initial Therapy	Trimethoprim/Sulfamethoxazole 160/800mg PO/IV q6h for 10 days **OR** Trimethoprim/Sulfamethoxazole 320/1600mg PO/IV q12h for 10-14 days	Pyrimethamine 50-75mg PO q24h **PLUS** Folinic acid 5-10mg PO q24h; **OR** Ciprofloxacin 500mg PO q12h	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Nocardia			
Initial Therapy	Trimethoprim **PLUS** Sulfamethoxazole (TMP 15mg/kg/24h + SMX 75mg/kg/24h) IV or PO in four divided doses. May consider decreasing to SMX/TMP (TMP 10mg/kg/24h) after clinical improvement	Imipenem/Cilastatin 500mg IV q6h **PLUS** Amikacin[1] 7.5mg/kg IV q12h for 2-4 weeks or clinical improvement followed by oral regimen **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12-24h **PLUS** Amikacin[1] 7.5mg/kg IV q12h for 2-4 weeks or clinical improvement followed by oral regimen	Use indefinite low dose oral suppression in patients with advanced HIV or significant immunosuppression to prevent relapse with TMP-SMX 160/800 q12h
Penicilliosis			
Initial Therapy	Induction regime: Amphotericin B 0.6-0.7mg/kg IV q24h for 2 weeks Continuation phase: (12 weeks) Itraconazole 200mg PO q12h Chronic maintenance therapy: Itraconazole 200mg PO q24h	In less severe disease: Itraconazole 200mg PO q8h for 3 days, then 200mg PO q12h for 12 weeks	Consider discontinuation among patients who remain asymptomatic, with CD4+ count >100-200 cells/µL for >6 months Syrup Itroconazole has better bioavailability and hence preferred by some for the induction phase in less severe disease (same dose)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Progressive Multifocal Leukoencephalopathy (PML)			
Initial Therapy	No effective therapy exists		With HAART, some patients improve and others stabilise. Few may deteriorate due to immune reconstitution
Cryptosporidiosis			
Initial Therapy	Symptomatic treatment of diarrhoea		Effective ART (to increase CD4+ count to >100) can result in complete, sustained clinical, microbiological and histologic resolution

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

C. SOLID TRANSPLANT

Approach to Post-Solid Organ Transplant - related Infections

(Renal and Liver Transplantation)

As most organ transplant recipients require immunosuppression, which though remarkably effective at controlling rejection, can produce a wide range of undesirable side-effects, especially a predisposition to serious infections. This chronic risk of infection, with its diagnostic problems and potentially fatal outcome, mandates an understanding of the principles of transplant-associated infections.

The following brief discussion of the approach to transplant-associated infections is meant to assist, alert and orient the physician who does not deal routinely with infections in the compromised host.

Consultation with infectious disease physician is recommended.

Important considerations in transplant-related infection;

- Tissue rejection notoriously mimics infections in solid organ transplantation. In all febrile episodes, the clinician must first consider rejections as a cause of fever.
- Medication side effects can cause fevers; thus the drug list should be reviewed for possible causative agents.
- The presenting features of infection in patients on immunosuppressive therapy may be vague as the impaired inflammatory response results in a paucity of physical signs and atypical presentation of infective processes. The insidious onset and rapid progression of infections warrant a prompt, thorough evaluation early in the course of any febrile event. The initiation of empiric broad-spectrum antibiotics is reasonable in patients with rigors or leucopenia. Opportunistic organisms are important considerations in the evaluation of febrile episodes in transplant patients and these include the following: cytomegalovirus (CMV), herpes simplex virus (HSV), fungal infections eg. candida and aspergillus, pneumocystis, mycobacteria, etc. There exist an 'infection timetable' especially in renal and heart transplant, whereby some specific pathogens often cause infections at certain time intervals from onset of immunosuppressions. (Figure 1)

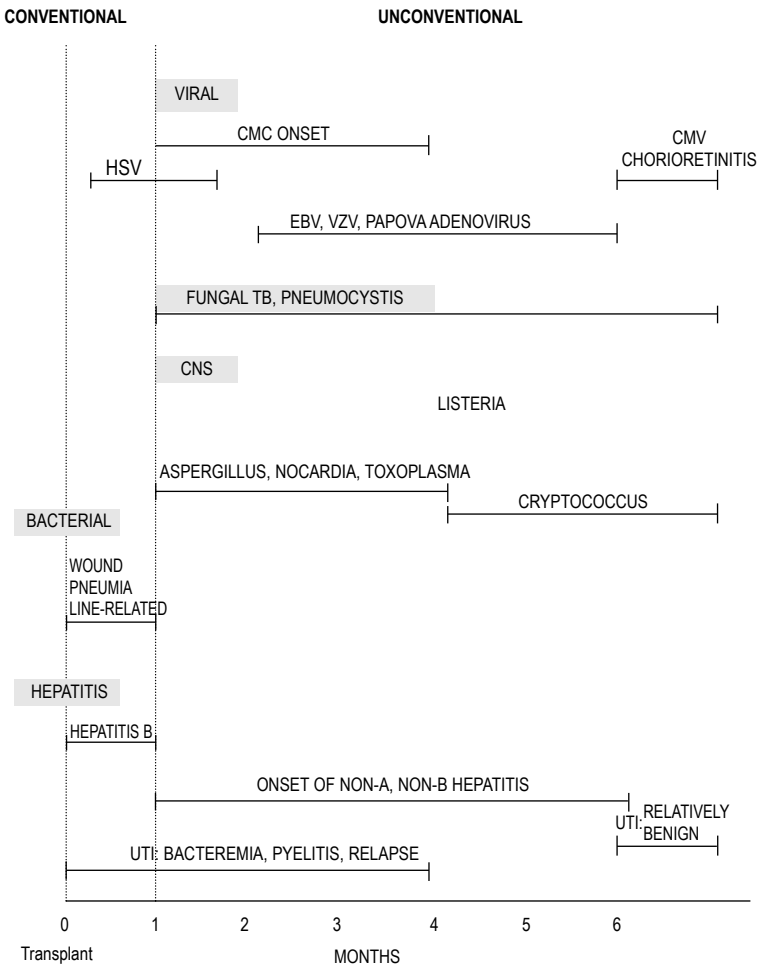

Figure 1

Timetable of occurrence of infection in renal transplant recipient

Post Liver Transplant-related Infections:

Febrile episodes in orthotopic liver transplant (OLT) are caused by infections in 80% of cases. Predominant causes of fever are bacterial infections (62%), viral (6%); whereas rejection accounts for only 4% of febrile episodes.

Bacteraemic infections are a major cause of death among organ transplant patients; for liver transplant patients the portal of entry is mainly the gastrointestinal and biliary tract with *Pseudomonas aeruginosa* and Enterobacter species having particularly high fatality rates. These infections are often seen in the early post transplant period (< 100 days). Stool cultures obtained before OLT are useful for choice of perioperative prophylactic/empirical antibiotics.

The most common sites of infection are generally in the abdomen followed by the blood stream. Commonest infections are bacterials followed by fungal infections. Gram positive aerobic bacterial infections are more common than Gram negative infections with portal vein thrombosis being an important risk factor for early bacterial infection.

The need of empirical antibiotic therapy in transplant patients with pulmonary infiltrates in intensive care units (ICU) can be assessed using several factors including; clinical pulmonary infection score (Pugin score) > 6, abnormal temperature and serum creatinine > 1.5mg/dl. Pugin score > 6 warrants antimicrobial therapy. Common causative bacterial organisms include; *Methicillin Resistant Staphylococcus aureus* (MRSA), Pseudomonas aeruginosa, *Enterobacter spp.* and *Serratia marcesens.* Aspergillus pulmonary infections should also be suspected in early onset pneumonia within 30 days of transplantation.

CMV infection is a common post-transplant occurrence; it maybe primary or secondary (ie. reactivation); being the most common cause of hepatitis in liver allograft patients. Infection usually presents within 90 days of transplant and continue for months (even years) in those with poor graft function requiring heavy immunosuppression. Long term Ganciclovir for the first 100 days post-transplant largely eliminates CMV infection.

INFECTIONS IN INTENSIVE CARE UNIT

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
A. Severe Sepsis Or Septic Shock Where Site Of Infection Is Not Identified			
Severe sepsis or septic shock (site of infection is unknown) *Gram-negative bacilli* *Gram-positive cocci*	Cefepime 2g IV q12h **OR** Piperacillin/Tazobactam 4.5g IV q8h	Meropenem 1g IV q8h **OR** Imipenem 500mg IV q6h	Current evidence suggests that carbapenems, 4th generation cephalosporins or Piperacillin/ Tazobactam are equally effective in treatment of septic shock If melioidosis cannot be ruled out, carbapenem should be used as the empirical agent
Methicillin-resistant S. Aureus *Penicillin-resistant S. Pneumoniae* *Ampicillin-resistant Enterococci*	**PLUS OPTIONAL** Vancomycin[1] 1g IV q12h		Empirical use of Vancomycin[1] is only justified in areas with high endemic levels of MRSA or high levels of penicillin-resistant S. pneumoniae
Candida	**PLUS OPTIONAL** Fluconazole 400-800mg IV q24h	**PLUS OPTIONAL** Amphotericin B 0.6-1.0mg/kg IV q24h	Empirical antifungal agents should not be used on a routine basis *Reference 1, 2*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
B. Severe Community-Acquired Pneumonia Requiring Mechanical Ventilation			
Severe community-acquired pneumonia requiring mechanical ventilation *S. Pneumoniae* *H. Influenzae* *S. Aureus* *K. Pneumoniae* *M. Pneumoniae* *L. Pneumophilia* *C. Pneumoniae* **B. Pseudomallei*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h **PLUS** Erythromycin 500mg IV q6h **OR** Azithromycin 500mg IV q24h *If risk factors present, consider Ceftazidime (Please refer to Page 95 (LRTI))	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **PLUS** Erythromycin 500mg IV q6h **OR** Azithromycin 500mg IV q24h	*Reference 3, 4, 5*
C. Severe Nosocomial Pneumonia Requiring Mechanical Ventilation (Including Ventilator-Associated Pneumonia)			
Nosocomial pneumonia requiring mechanical ventilation (including VAP) **Low risk for infection with multi-drug resistant (MDR) organisms - < 5 days** *S. Pneumoniae* *H. Influenzae* *S. Aureus* *E. Coli* *K. Pneumoniae* *Enterobacter spp.* *Proteus spp.* *Serratia Marcescens*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q6h	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h	S. aureus is more common in diabetes mellitus, head trauma Monotherapy is recommended for early onset HAP/VAP/HCAP *Reference 6, 7*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
High risk for infection with multi-drug resistant (MDR) organisms			
P. Aeruginosa	Piperacillin/Tazobactam 4.5g IV q6h **OR** Cefepime 2g IV q12h **PLUS** Amikacin[1] 15mg/kg/24h IV **OR** Ciprofloxacin 400mg IV q8h	Imipenem 500mg IV q6h **OR** Meropenem 1g IV q8h **PLUS** Amikacin[1] 15mg/kg/24h IV **OR** Ciprofloxacin 400mg IV q8h	Use combination therapy if MDR pathogen is suspected Aminoglycoside can be stopped after 5-7 days in patients on combination therapy who are responding to treatment
Acinetobacter spp.	Cefoperazone/Sulbactam 2g IV q12h	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q6h	
K. Pneumoniae (ESBL)	Meropenem 1g IV q8h **OR** Imipenem 500mg IV q6h		
Methicillin-resistant *S. Aureus*	**PLUS** **(if MRSA is suspected)** Vancomycin[1] 1g IV q12h		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

References:
1. Crit Care Med 2003; 31:1250-1256
2. Crit Care Med 2004; 32(11)S495 S512
3. Am J Respir Crit Care Med 2002, 166:717-723
4. Clin Infect Dis 2003; 37:1405-33
5. Curr Opin Crit Care 2004; 10:59-64
6. Am J Respir Crit Care Med. 2005; 171:388-416
7. Curr Anaes and Crit Care 2005;16:209-219

OBSTETRICS & GYNAECOLOGICAL INFECTIONS

A. OBSTETRICS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Intrapartum prophylaxis for GBS *(Group B. Streptococcus), positive mothers*	Intrapartum Benzylpenicillin 5 mega units IV followed by 2.5 mega units IV q4h	Intrapartum *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV followed by 750mg q8h **OR** Ampicillin 2g IV as loading dose followed by 1g IV q4h, to stop after delivery **If allergic to penicillin (non-anaphylactic):** Cefuroxime 1.5g IV followed by 750mg IV q6-8h **If life threatening (anaphylactic):** Erythromycin 500mg IV q6h, if susceptible	RCOG Guidelines
PPROM (Preterm Premature Rupture of Membranes) *Mixed*	EES 400mg PO q12h for 10 days	Amoxycillin 500mg PO q8h **OR** Cefuroxime 250mg PO q12h for 10 days	RCOG guidelines

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Chorioamnionitis *Gram (-) rods/* *Gram (+) coccus/* *Anaerobes*	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 750mg IV q8h **OR** Cefoperazone 1g IV q12h **PLUS** Metronidazole 500mg IV q8h for 3 days followed by oral treatment for 7 days **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q8h for 3 days followed by oral treatment for 7 days	Ampicillin 1g IV q6h **PLUS** Metronidazole 500mg IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h for 7 days	RCOG Guidelines
Puerperal Sepsis Mixed:- *Streptococcus* *Staphylococcus* *Gram Negative Bacilli* *Anaerobes*			

B. GYNAECOLOGY

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Pelvic Inflammatory Disease			
C. Trachomatis *Bacteroides sp.* *Gardnerella Vaginalis* *E. Coli* *Streptococcus* *Coagulase-negative Staphylococcus*	**IV THERAPY (for moderate to severe disease):** *2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 750mg IV q8h **OR** Ceftriaxone 2g IV q24h **PLUS** Doxycycline 100mg PO q12h **PLUS** Metronidazole 400mg PO q8h Duration of treatment is 14 days **OUTPATIENT THERAPY (for mild disease):** Cefuroxime 250-500mg PO q12h **PLUS** Doxycycline 100mg PO q12h **PLUS** Metronidazole 400mg PO q8h *If gonococcal infection suspected, Refer to Page 100 (Sexually Transmitted Infections)*	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5-3g IV q6h **PLUS** Doxycycline 100mg PO q12h	Antibiotic should be changed accordingly after C&S results available

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Vaginitis			
Bacterial Vaginosis *Gardnerella Vaginalis*	Metronidazole 400mg PO q12h for 7 days	Clindamycin 300mg PO q12h for 7 days	- Metronidazole is best avoided in the first trimester of pregnancy - In pregnancy, treatment is indicated for symptomatic disease and asymptomatic women at high risk for preterm delivery - Avoid alcohol (antabuse effect)
Candidiasis *Candida Albicans*	Clotrimazole 500mg as a single vaginal pessary (stat dose) Clotrimazole 200mg as vaginal pessary for 3 nights	Tinidazole 500mg PO q12h for 5 days **OR** Tinidazole 2g PO stat	Metronidazole/Tinidazole are best avoided in the first trimester of pregnancy
Trichomoniasis *Trichomonas Vaginalis*	Metronidazole 200mg PO q8h for 7 days **OR** Metronidazole 400mg PO q12h for 7 days **OR** Metronidazole 2g PO stat	<u>In pregnancy:</u> Clotrimazole pessary 100mg daily for 7 days, but systemic treatment will ultimately be necessary to eradicate the infection	Avoid alcohol (antabuse effect)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Septic Miscarriage			
Streptococcus *Staphylococcus* *Gram Negative Bacilli* *Anaerobes*	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 750mg IV q8h **OR** Cefoperazone 1g IV q12h **PLUS** Metronidazole 500mg IV q8h for 3 days followed by oral treatment for 7 days **OR** β-lactam/β-lactamase inhibitors, e.g. Ampicillin/Sulbactam 1.5g IV q8h for 3 days followed by oral treatment for 7 days	Ampicillin 500mg IV q6h **PLUS** Metronidazole 500mg IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h for 7 days	

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

OCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Blepharitis *Staph. Aureus* *Staph. Epidermidis*	Chloramphenicol 1% eye ointment applies q6h to lid margins Duration as required	Chlortetracycline 1% eye ointment apply q6h **OR** Fusidic Acid 1% eye ointment apply q6h	In resistant cases, Doxycycline 100mg PO q24h or Tetracycline 250mg PO q6h for 2 to 4 weeks or as necessary Incision and curettage may be required
Internal Hordeolum with Secondary Infection *Staph. Aureus*	Chloramphenicol 1% eye ointment apply q6h for 1 week	Chlortetracycline 1% eye ointment apply q6h for 1 week	Topical antibiotics NOT indicated unless keratitis is present. Topical saline drops for toilet
External Hordeolum (stye) *Staph. Aureus*	Chloramphenicol 1% eye ointment apply q6h for 1 week	Chlortetracycline 1% eye ointment apply q6h for 1 week	
Gonococcal Conjunctivitis (including neonates) *Neisseria Gonorrhoea*	Needs systemic therapy Refer to Page 100 (Sexually Transmitted Infections) & Page 177 (Neonatal Infections)		Topical antibiotics NOT indicated unless keratitis is present. Topical saline drops for toilet
Chlamydial Conjunctivitis (including neonates) *Chlamydial Trachomatis*	Needs systemic therapy Refer to Page 99 (Sexually Transmitted Infections) & Page 177 (Neonatal Infections)		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Adult Inclusion Conjunctivitis or Trachoma *Chlamydia Trachomatis*	Needs systemic therapy Refer to Page 100 (Sexually Transmitted Infections) and Page 177 (Neonatal Infections)		Exclude other STD's. Treat sexual partners
Bacterial Conjunctivitis *Staph Aureus, Strep Pneumonia, H. Influenzae*	Chloramphenicol 0.5% eye drop apply q2-4h for 1 week	Gentamicin 0.3% eye drop apply q2-4h for 1 week	
Bacterial Keratitis Mixed Growth/ No Growth	*Cefuroxime 5% eye drop apply hrly **PLUS** *Gentamicin 0.9% or 1.4% eye drop apply hrly	Ciprofloxacin 0.3% eye drop apply hrly	In severe keratitis, commence a loading dose of one drop every 15 minutes for 3 hours followed by hourly drops around the clock. Taper based on clinical response *prepare ready to use extemporaneous by using injectable forms
Bacterial Keratitis Gram-Positive Cocci Gram-Negative Rods Gram-Negative Cocci	*Cefuroxime 5% eye drop apply hrly **Gentamicin 0.9% or 1.4% eye drop apply hrly *Ceftazidime 5% eye drop apply hrly	Ciprofloxacin 0.3% eye drop apply hrly *Ceftazidime 5% eye drop apply hrly Ciprofloxacin 0.3% eye drop apply hrly	*Vancomycin 5% eye drop may be indicated for MRSA *Cefuroxime 5% eye drop, Ceftazidime 5% eye drop, Vancomycin 5% eye drop - prepare ready to use extemporaneous by using injectable forms. **Gentamicin 0.9% & 1.4% eye drop - prepare Fortified Gentamicin Eye Drops

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Contact Lens Related Bacterial Keratitis *Pseudomonas*	**Gentamicin 0.9% or 1.4% eye drop apply q1-2h **PLUS** *Ceftazidime 5% eye drop apply q1-2h	Ciprofloxacin 0.3% eye drop apply hrly	*Ceftazidime 5% eye drop- prepare ready to use extemporaneous by using injectable forms **Gentamicin 0.9% & 1.4% eye drop - prepare Fortified Gentamicin Eye Drops
Gonococcal Keratoconjunctivitis *Neisseria Gonorrhoea*	Ocular Treatment: Ciprofloxacin 0.3% eye drop apply hrly Refer to Page 100 (Sexually Transmitted Infections) & Page 177 (Neonatal Infections)	Ocular Treatment: *Ceftazidime 5% eye drop apply hrly	*Ceftazidime 5% eye drop - prepare ready to use extemporaneous using injectable forms
Herpes Simplex Keratitis *Herpes Simplex* Type 1 and 2	Acyclovir 3% eye ointment apply 5 times/day until the epithelium heals then taper		Acyclovir 3% eye ointment should not be used for more than 6 weeks due to toxicity
Herper Zoster Ophthalmicus *Herpes Zoster Virus*	Needs systemic therapy Refer to Page 108 (Skin & Soft Tissue Infections)		
Acanthamoeba Keratitis *Acanthamoeba sp.*	*Chlorhexidine 0.02% eye drop **PLUS** Neomycin 0.5% eye ointment apply hrly		*Chlorhexidine 0.02% eye drop prepare ready to use extemporaneous

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Fungal Keratitis Filamentous Fungi/Yeast	***Fluconozole 0.2% eye drop q1-2h **PLUS/MINUS** Amphotericin B 0.15%-0.2% eye drop q1-2h **PLUS** Fluconozole 200mg PO q24h	**Natamycin 5% q1-2h for 3-4 days, then q3-4h for 2-3 weeks **PLUS** Amphotericin B 0.15% to 0.2% eye drop q1-2h **PLUS** Ketoconazole 200mg PO q24h	Treatment depending on the severity of the infection **requires DG approval ***Fluconazole 0.2% eye drop - prepare ready to use extemporaneous
Dacryocystitis *Strep Pneumonia, Staph Aureus Gram -ve Anaerobes*	Amoxycillin 500mg PO q8h for at least 5 days	Cephalexin 500mg PO q6h for at least 5 days	Consider corresponding intravenous antibiotics in severe infections
Preseptal Cellulitis *Strep Pneumoniae, Staph Aureus, Strepcoccus sp.*	Cloxacillin 500mg-1g PO q6h for 5 days	Amoxycillin 500mg PO q8h	Consider corresponding intravenous antibiotics: - in severe infections - if secondary to sinusitis
Ocular Toxoplasmosis *Toxoplasma Gondii*	Needs systemic therapy Refer to Page 53 (Human Immunodeficiency Virus)		
Acute Retinal Necrosis Herpes Simplex	Needs systemic therapy Refer to Page 53 (Human Immunodeficiency Virus)		Systemic steroid is indicated depending on location or severity of the infection

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
CMV Retinitis Cytomegalovirus	Needs systemic therapy Refer to Page 53 (Human Immunodeficiency Virus) Ocular Treatment: Intravitreal Ganciclovir 2mg/0.1ml (weekly) - (Prefer: Ganciclovir implant: 4.5g - if available)	Ocular Treatment: Intravitreal *Foscarnet 2.4mg/0.1ml (1-2 weekly)	Intravitreal to be repeated according to clinical response *Requires DG approval To continue until CD4 count is > 150 cell/mm^3
Ocular Syphilis *Treponema Pallidum*	Needs systemic therapy Refer to Page 100 (Sexually Transmitted Infections)		Referral to neurologist prior to starting treatment
Ocular Tuberculosis *Mycobacterium Tuberculosis*	Needs systemic therapy Refer to Page 143 (Tuberculosis Infections)		Systemic steroid may be indicated but is only for - non-active systemic TB - severe ocular inflammation and vision threatening condition

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Orbital Cellulitis/abcess *Strep Pneumoniae, Staph Aureus, Strepcoccus sp.* *Gram -ve Anaerobes*	Cefuroxime 750mg-1.5g q8h **OR** Cloxacillin 1-2g IV q6h **PLUS** Ceftriaxone 1-2g IV q24h **If sinusitis is suspected as the cause ADD:** Initial Metronidazole 15mg/kg IV infused over 1 hr Anaerobic infection: maintenance, 7.5mg/kg/hr IV q6h, starting 6 hrs after initial dose; maximum 4g/day Treat for 5 days		Treat underlying cause (e.g. sinusitis) In orbital abscess, surgical drainage is often necessary References: 1. Medical and Surgical Management of Orbital Cellulitis Michael T. Yen, M.D. Contemporary Ophthalmology, June 2005, Vol. 4, No. 11, Page 1-6 2. Role of Inflammation in Orbital Cellulitis Carolyn E. Kloek, MD Peter A.D. Rubin, MD Manuscript on Role of Inflammation in Orbital Cellulitis Page 57-68
Post Operative Fungal Endophthalmitis	Intravitreal Amphotericin B 0.005mg in 0.1ml	*Intravitreal Miconazole: (0.01mg in 0.1ml)	*Requires DG approval CPG for Management of Post-Operative Endophthalmitis, Ministry of Health Malaysia, August 2006

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Post Operative Bacterial Endophthalmitis *Staphylococcus Epidermidis* *Staphylococcus Aureus* *Pseudomonas Aeruginosa,* *Bacteroids Species* *Streptococcus Pneumoniae, Alpha-Haemolytic Streptococci*	Intravitreal antibiotic injections: Vancomycin 1-2mg in 0.1ml and Ceftazidime 2mg in 0.1ml **If suspicious of fungal endophthalmitis, ADD:** Intravitreal Amphotericin B 0.005mg in 0.1ml ALSO consider in culture negative cases with poor clinical response: Ciprofloxacin 250mg PO q12h	Intravitreal antibiotic injections Vancomycin 1-2mg in 0.1ml and Amikacin 0.4mg in 0.1ml Clarithromycin 250-500mg PO q12h for 7-14 days	1. Begin intensive topical antibiotics and topical steroid soon after intravitreal antibiotic injection 2. Systemic antibiotics for severe, virulent endophthalmitis 3. Oral prednisolone to be considered and may be given 24 hours following intravitreal antibiotics injection 4. Review antibiotic regimen after microbiology results 5. Repeat intravitreal antibiotics after 48 to 72 hours if indicated EARLY REFERRAL TO A VITREORETINAL CENTER IS RECOMMENDED *CPG for Management of Post-Operative Endophthalmitis, Ministry of Health Malaysia, August 2006*

ORAL/DENTAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. ANTIMICROBIAL USE FOR BACTERIAL INFECTIONS			
A. Infections of the Teeth and Supporting Structures			
Reversible/Irreversible Pulpitis	Systemic antibiotic use not recommended		**Endodontic treatment and symptomatic relief of pain** *Cochrane Database of Systematic Reviews* 2005, Issue 2. Art. No: CD004969. DOI: 10.1002/14651858.CD004969.pub2
Localised Dentoalveolar Abscess	Systemic antibiotic use not recommended		**Incision and Drainage and management of cause of abscess and symptomatic relief of pain** *J Can Dent Assoc* 2003 Nov 69(10):660
Dry Socket	Systemic antibiotic use not recommended		**Local treatment with saline irrigation and antiseptic/analgesic dressings and symptomatic relief of pain** *Med Oral Patol Oral Cir Bucal* 2005; 10:77-85
Localised Pericoronitis	Systemic antibiotic use not recommended		**Local treatment with antiseptic irrigation and mouthwash and symptomatic relief of pain** *J Clin Microbiol.* 2003; 41(12):5794-7

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Chronic Gingivitis	Systemic antibiotic use not recommended		**1st line treatment - Mechanical plaque control** **2nd line treatment - Antimicrobial mouth rinse** *Clinical Periodontology - 9th ed. 2002*
Chronic Periodontitis	Systemic antibiotic use not recommended		**1st line treatment - Mechanical plaque control** *Eur J Prosthodont Restor Dent*. 2004 Jun; 12(2): 63-9 CPG Management of chronic periodontitis 2005 MOH, Malaysia
Aggressive Periodontitis *A. Actinomycetemcomitans,* *P. Gingivalis,* *Tannerella Forsythensis,* *P. Intermedia,* *Spirochaetes*	*Amoxycillin 500mg PO q8h **PLUS** *Metronidazole 400mg PO q8h	*Doxycycline 100mg PO q12-24h **OR** *Clindamycin 150-300mg PO q6h	**Antibiotics are not used alone but are used as an adjunct to scaling and root debridement** *J Periodontol* 2004; 75: 1553-1565 *J Clin Periodontol*. 2005 Oct; 32(10): 1096-107 *Evid Based Dent*. 2006; 7(3): 67. *Treatment depending on severity of infection

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Localised Periodontal Abscess	Systemic antibiotic use not recommended		**Incision and Drainage and management of cause of abscess and symptomatic relief of pain** *CPG = Management of periodontal abscess - MOH, Malaysia* April 2004
B. Infections of the Jaws			
Osteomyelitis of the jaws of dental origin *Different organisms may be involved*	For acute cases, start with: Phenoxymethylpenicillin 250-500mg PO q6h **OR** *Benzylpenicillin 1-2 mega units IV q6h	*Clindamycin 150-300mg PO q6h **OR** *Clindamycin 150-450mg IV q6h	**Culture and sensitivity is necessary** **For chronic cases, start with surgical treatment first. Antibiotics only when causative organisms are identified** *Treatment depending on severity of infection

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
C. Spreading Infections and Infections of Fascial Spaces (with/without Systemic Signs)			
Cellulitis ± Abscess of dental origin *Viridans Streptococci, Staphylococci, Prevotella, Peptostreptococcus*	Benzylpenicillin 2-4 mega units IV stat then 1-2 mega units IV q4-6h* **PLUS/MINUS** Metronidazole 500mg IV q8h (or 1g q12h)*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q6-8h (not more than 1.2g in a single dose - max 7.2g daily)*	*J Oral Maxillofac Surg* 2006; 64:1377-1380 *Asian J Oral Maxillofac Surg* 2005; 17:168-172 *Antimicrobial Agents and Chemotherapy*, 1995; 39(10):2243-47 *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; 90:600-8 *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005; 100:550-8 *J Craniomaxillofac Surg* 1995; 23:38-41 *Int J Antimicobial Agents* 2000; 15:1-9 *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004; 98:398-408 *J Craniomaxillofac Surg*. 2005 Feb 33(1):24-9 *Journal of Emergency Medicine*, 1999; 17(1):189-195 *Treatment depending on severity of infection
Surgical site infection & Traumatic wound infection (Infection is usually by endogenous organisms rather than exogenous) *Viridans Streptococci* *Staphylococci* *Prevotella, Peptostreptococcus, Eubacterium,* and *Fusobacterium*	**PLUS** Cloxacillin 500mg-1g IV q6h (in skin involvement - if Staph. expected) **OR** Clindamycin 150-450mg IV q6h* Oral administration: Amoxycillin 250-750mg PO q8h* **PLUS/MINUS** Metronidazole 400mg PO q8-12h* **OR** Clindamycin 150-450mg PO q6h*	**OR** Cefuroxime 750mg-1.5g IV q8h **PLUS/MINUS** Metronidazole 500mg IV q8h (or 1g q12h)* **OR** If not responding to above antibiotics, *3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h* (may be given up to 4g per day) Oral administration: *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h. If severe, 625mg PO q8h* **OR** Cefuroxime 250-500mg PO q12h*	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
D. Post Implant Infections ("Periimplantitis")			
Actinomyces sp. *Eubacterium sp.* *Propionibacterium sp.* *Lactobacillus sp.* *Veillonella sp.* *P. Gingivalis* *Prevotella Intermedia* *F. Nucleatum*	Amoxycillin 250-500mg PO q8h* **PLUS** Metronidazole 200-400mg PO q8h*	Doxycycline 100mg PO q12-24h* **OR** Clindamycin 150-300mg PO q6h*	Bacteria associated with periimplantitis are extremely resistant to antibiotics Antibiotics are not used alone but are used as an adjunct to local mechanical and chemical debridement Also irrigation with Chlorhexidine and optimal oral hygiene by patient *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005; 100:550-8 *Periodontol* 2000-2002; 28:177-89 *Treatment depending on severity of infection

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
2. ANTIMICROBIAL USE FOR FUNGAL INFECTIONS			
A. Oral Candidiasis			
Acute Pseudomembranous Candidiasis *Candida sp.*	Nystatin (topical) 500,000 units q6h for up to 4 weeks Systemic antifungal for severe infections, severely immunocompromised patients and for infections resistant to topical antifungal: Fluconazole 50-100mg PO/IV q24h for 2 weeks **OR** Itraconazole 100mg PO q24h for 2 weeks		Use chlorhexidine mouthwash as adjunct *J Prosthetic Dent*. 1989; 61:699 J Biol Buccale 1992; 20:45 *Oral Surg. Oral Med. Oral Pathol*. 1992; 73 (6):682-689 *Crit. Rev. Oral Biol. Med*. 2000; 11:172-198 *Clin. Infect. Dis*. 1994; 18(3):298-304
Hyperplastic Candidiasis (Candidal Leukoplakia)	Nystatin (topical) 500,000 units q6h for up to 4 weeks Systemic antifungal for infections resistant to topical antifungal: Fluconazole 50-100mg PO/IV q24h for 2 weeks **OR** Itraconazole 100mg PO q24h for 2 weeks		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Candida-associated denture stomatitis with or without angular chelitis	Local measures first Consider antifungal if local measures fail Nystatin (topical) 500,000 units q6h for up to 4 weeks		
3. ANTIMICROBIAL USE FOR VIRAL INFECTIONS			
Primary Herpes Simplex Infection (Primary herpetic gingivostomatitis) *Herpes Simplex Virus*	Symptomatic treatment only in most cases For severe infections may consider: For adult & healthy patients Acyclovir 200-400mg PO 5 times daily for 5-7 days For immunocompromised patients: Acyclovir 250mg/m^2 IV q8h		*J Am Acad Dermatol* 1988 January: 18 (1 Part 2):176-179 *Drug Intell Clin Pharm* 1985 July-August; 19 (7-8):518-524
Secondary Herpes Simplex Infection *Herpes Simplex Virus*	Acyclovir 5% cream to be applied q6h For external use only		*J Infect Dis* 1990; 161 (2):185-190 *JAMA* 1988; 260 (11):1597-1599 *Ann Intern Med* 1993; 118:268-272

RESPIRATORY INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
A. UPPER RESPIRATORY TRACT INFECTIONS			
1. Throat And Upper Respiratory			
Acute Tonsillitis **Acute Pharyngitis** *Strep. Pyogenes, Group A Beta Hemolytic Streptococcus*	Phenoxymethylpenicillin 250-500mg PO q8h for 10 days **OR** (in penicillin allergic patients) EES 400mg PO q12h for 10 days		Antibiotics should be prescribed in suspected/proven bacterial infections, only as sore throats are common viral in origin. In severe cases, start with parenteral penicillin In infections of the throat and tonsil due to mononucleosis, Ampicillin/ Amoxycillin frequently precipitates a non-allergic rash (this is not an indication of Penicillin hypersensitivity) *Practice Guidelines for the Diagnosis and Management of Group A Streptococcal Pharyngitis. Clinical Infectious Diseases 2002*
Acute Peritonsillar Abscess *Streptococcus Pyogenes, Fusobacterium*	Benzylpenicillin 2-4 mega units IV q6h followed by Phenoxymethylpenicillin 500mg PO q6h for 10 days **PLUS/MINUS** Metronidazole 500mg IV q8h followed by Metronidazole 400mg PO q8h	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h followed by Amoxycillin/Clavulanate 625mg PO q12h for 10 days **OR** Ampicillin/Sulbactam 1.5g IV q8h followed by Ampicillin/Sulbactam 375mg PO q12h for 10 days	Abscess to be drained

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Diphteria *Corynebacterium Diphtheriae*	Benzylpenicillin 50,000 units/kg/24h IV for 5 days followed by Phenoxymethylpenicillin 50mg/kg/24h PO for 5 days		Antitoxin and supportive treatment are critical in management. Antibiotic is not the mainstay of treatment
Acute Epiglottitis *Haemophilus Influenzae Type b, Streptococcus Pneumoniae*	*2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 750mg IV q8h, may be followed by Cefuroxime 250mg PO q12h for total of 14 days **OR** Ceftriaxone 1g IV q24h	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h; may be followed by Amoxycillin/Clavulanate 625mg PO q12h for 14 days **OR** Chloramphenicol 500mg-1g IV q6h, may be followed by 250-500mg PO q12h for 14 days	Urgent hospitalisation. May present with life threatening upper airway obstruction, especially in paediatrics
Deep Neck Abscess *Polymicrobial, S. Aureus, Strep. sp., Bacteroides sp.*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h; **OR** Cefuroxime 750mg IV q8h **PLUS** Metronidazole 500mg IV q8h for at least 7 days	*2nd or 3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV q24h **PLUS** Metronidazole 500mg IV q8h for at least 7 days	Abscess needs to be drained

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
2. Rhinology			
Acute Bacterial Rhinosinusitis (ABRS) *Streptococcus Pneumoniae, Haemophilus Influenzae, Moraxella Catarrhalis*	Amoxycillin 500mg PO q8h for 7-14 days **OR** *(in penicillin allergic patients)* EES 400mg PO q12h for 7-14 days	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 7-14 days **OR** (in penicillin allergic patients) Cefuroxime 500mg PO q12h for 7-10 days **OR** *Macrolides, e.g.* Azithromycin 500mg PO q24h for 3 days	The Cochrane Database of Systematic Reviews 2004, Issue 1
Subperiosteal Abscess Secondary to ABRS *S. Pneumoniae,* *S. Pyogenes,* *H. Influenzae*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h for 10-14 days **OR** Cefuroxime 750mg IV q8h for 10-14 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV q24h for at least 10 days	Abscesses must be drained

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
3. Otology			
Acute Otitis Media *Streptococcus Pneumoniae, Haemophilus Influenzae*	Amoxycillin 500mg PO q8h for 7 days **OR** *(in penicillin allergic patients)* EES 400mg PO q12h for 7 days	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 7 days	Myringotomy may be required in cases of impending rupture of tympanic membrane
Malignant Otitis Externa/ Necrotizing Otitis Externa *Pseudomonas Aeruginosa*	Ciprofloxacin 400mg IV q12h followed by Ciprofloxacin 500-750mg PO q12h for 6 weeks		Aural toileting required. Surgical debridement normally required
Acute Mastoiditis/ Mastoid Abscess *S. Pneumoniae, S. Pyogenes, Coag.-negative Staph, S. Aureus, Proteus* and *Bacteroides sp.*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h followed by Amoxycillin/Clavulanate 625mg PO q12h for 7-14 days **OR** Ampicillin/Sulbactam 1.5g IV q8h followed by Ampicillin/Sulbactam 375mg PO q12h **OR** Cefuroxime 750mg IV q8h followed by Cefuroxime 250mg PO q12h	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV q24h for 7-14 days	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute Diffuse Otitis Externa *P. aeruginosa and Staph Aureus*	Framycetin Sulphate 0.5%, Dexamethasone 0.05% & Gramicidin 0.005% ear drop 2-3 drops 3-4 times/day for 7 days	Ofloxacin 0.3% otic solution 6-10 drops q12h for 10 days	Aural toileting required in discharging ears The dosage should be reduced appropriately for children
Chronic Suppurative Otitis Media *P. aeruginosa, Staph Aureus and Epidermidis, Proteus sp.*	Ofloxacin 0.3% otic solution 6-10 drops twice a day for 10 days **OR** Framycetin Sulphate 0.5%, Dexamethasone 0.05% & Gramicidin 0.005% ear drop 2-3 drops 3-4 times/day for 7 days		Aural toileting required in discharging ears The dosage should be reduced appropriately for children
Otomycosis *Aspergillus sp.*	Kenacomb Otic Drops (Triamcinolone Acetonide 0.9mg/ml, Neomycin base 2.25mg/ml, Nystatin 90,000 units/ml and Gramicidin 0.225mg/ml) 2-3 drops 2-3 times/day for 2 weeks		Aural toileting required and tympanic membrane needs to be inspected prior to administration In paediatric patient, medication should be monitored, least amount and shortest duration compatible with effective therapeutic regimen

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
B. LOWER RESPIRATORY TRACT INFECTIONS			
1. Community Acquired Penumonia (CAP)			
Mild CAP (out-patient) **a. No comorbidity** *Streptococcus Pneumonia* *Mycoplasma Pneumoniae*	**No recent antibiotic therapy** EES 800mg PO q12h for 1 week **OR** Amoxycillin 500mg PO q8h for 1 week **Recent Antibiotic Therapy** Treat as b *(Presence of comorbidity or History of recent antibiotic therapy) as below*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 1 week **OR** Ampicillin/Sulbactam 375mg PO q12h for 1 week **OR** Doxycycline 100mg PO q12h for 1 week	
b. Presence of comorbidity or History of recent antibiotic therapy (2 months) *Streptococcus Pneumoniae* *Mycoplasma Pneumoniae* *Haemophilus Influenzae*	Azithromycin 500mg PO q24h for 3 days **OR** EES 800mg PO q12h for 1 week **PLUS** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 1 week	Levofloxacin 500mg PO q24h for 1 week	Conservative use of quinolone is recommended to minimise resistant pathogen. Use when patients failed first line regimens or allergic to alternative

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Moderate & Severe CAP (not requiring mechanical ventilation) *Streptococcus Pneumoniae* *Mycoplasma Pneumoniae* *Haemophilus Influenzae* *Klebsiella Pneumoniae* *Legionella* *Staphylococcus Aureus* Other Gram Negative Bacilli *- Enterobacter* *- Escherichia Coli*	Azithromycin 500mg IV/PO q24h **OR** Erythromycin 500mg IV q6h/EES 800mg PO q12h **PLUS** *3rd gen. Cephalosporins,e.g.* Ceftriaxone 1-2g IV q24h **OR** *β-lactam/β-lactamase inhibitors, e.g.* (Amoxycillin/Clavulanate OR Ampicillin/Sulbactam) Duration: 1 week	Levoflaxacin 500mg IV/PO q24h for 1 week	Empirical therapy for melioidosis should be considered if patient has diabetes mellitus Conservative use of quinolone is recommended to minimise resistant pathogen. Use when patients failed first line regimens or allergic to alternative
Pseudomonas Infection	Piperacillin/Tazobactam 4.5g IV q8h for 1 week **OR** Cefepime 2g IV q12h for 1 week **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Azithromycin 500mg IV q24h for 1 week For severe CAP Requiring Mechanical Ventilation. Refer to Page 68 (Infections In Intensive Care Units)	Piperacillin/Tazobactam 4.5g IV q8h for 1 week **OR** Cefepime 2g IV q12h for 1 week **PLUS** Ciprofloxacin 500mg IV q12h for 1 week	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
2. Lung Abscess Organisms likely to be involved are anaerobes (34%), Gram positive cocci (26%), *Klebsiella Pneumoniae* (25%), *S. Milleri* (16%), *Norcardia* (3%). If suspect melioidosis *Staphylococcus Aureus (e.g. among IVDU)*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h **PLUS** Metronidazole 500mg IV q8h followed by 400mg PO q8h for 4-6 weeks Ceftazidime 2g IV q8h for 10-14 days Cloxacillin 2g IV q4-6h for 2-4 weeks	Piperacillin/Tazobactam 4.5g IV q8h for 4-6 weeks	
3. Empyema Always investigate as per pleural effusion. Drainage via chest tube required. Tuberculosis must be excluded			
Empyema If Anaerobes isolated/suspected: *Strep Milleri* *Enterobacteriaceae* *Bacteroides sp.* If *Staphylococcus Aureus Isolated*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h **OR** Cefotaxime 1g IV q8h *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q24h **OR** Cefotaxime 1g IV q8h **PLUS** Metronidazole 500mg IV q8h Cloxacillin 2g IV q4h	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h Vancomycin 1g IV q12h (if MRSA suspected)	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
4. Acute Exacerbation of Chronic Bronchitis (AECB) - Chronic bronchitis - presence of both cough & sputum production on most days for at least 3 months each year for 2 consecutive years. Exacerbations are recurrent episodes of worsening respiratory symptoms. For classification of AECB please refer to Anthonisen et al. (Ann Int Med 1987; 106:196-204) and Seemungal et al (AJRCCM 1998; 157:1418-1422) - 40-50% AECB are caused by bacteria, usually H. Influenzae, S. Pneumoniae & M. Catarrhalis and 40% are due to viruses (influenzae A or B, rhinovirus, parainfluenzae, coronavirus			
Acute tracheobronchitis - usually viral	None unless symptoms persist > 7 days	EES 800mg PO q12h for 1 week **OR** Doxycycline 100mg PO q12h for 1 week	**Symptoms & risk factors:** Cough & sputum without previous pulmonary disease
Chronic bronchitis without risk factors (simple) *H. Influenzae* *Haemophilus spp* *M. Catarrhalis* *S. Pneumoniae* *Atypical Respiratory Pathogens*	Azithromycin 500mg PO q24h for 1 week **OR** *2nd or 3rd gen. Cephalosporins* (except ceftazidime)	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 1 week **OR** Doxycycline 100mg PO q12h for 1 week	**Symptoms & risk factors:** Increased cough & sputum, purulent sputum,and increased dyspnoea

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Chronic bronchitis with risk factors (complicated) *H. Influenzae* *M. Catarrhalis* *S. Pneumoniae* *Atypical Respiratory Pathogens* *Klebsiella sp* *Other gram negatives*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 1 week **OR** Ampicillin/Sulbactam 375mg PO q12h for 1 week	Levofloxacin 500mg PO q24h for 1 week	**Symptoms & risk factors:** As in *chronic bronchitis without risk factors* plus (≥ 1 of): FEV1 <50%, > 4 exacerbations/year, > 65 years, significant co-morbidity (especially heart disease), use of home oxygen, chronic oral corticosteroid use, antibiotic use in the past 3 months
Chronic suppurative bronchitis *H. Influenzae* *M. Catarrhalis* *S. Pneumoniae* *Atypical respiratory pathogens* *Klebsiella sp* *Other gram negatives* *Pseudomonas Aeruginosa* *Multi-resistant Enterobacteriacea*	Ambulatory patients: Tailor treatment to airway pathogen *Pseudomonas aeruginosa* common (Ciprofloxacin 500mg PO q12h) Hospitalised patients: parenteral therapy usually required		**Symptoms & risk factors:** As in chronic bronchitis with risk factors with constant purulent sputum, some have bronchiectasis, FEV1 usually < 35%, or multiple risk factors (e.g. frequent exacerbations & FEV1 < 50%)

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

References:

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8. Anzueto AR, Schaberg. Clinician's Manual On Acute Exacerbations Of Chronic Bronchitis. 2003, Science Press Ltd

SEXUALLY TRANSMITTED INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Primary Syphilis *Treponema Pallidum* Incubation period: 10-90 days	Procaine Penicillin 600,000 units IM q24h for 10 days **OR** Benzathine Penicillin 2.4 mega units IM weekly for 1 week	If allergic to penicillin: Doxycycline 100mg PO q12h for 14 days **OR** Tetracycline 500mg PO q6h for 14 days **OR** EES 800mg PO q12h for 14 days **OR** *Azithromycin 500mg PO q24h for 10 days **OR** *Amoxycillin 500mg PO q6h **PLUS** Probenecid 500mg PO q6h for 14 days **OR** *3rd gen. Cephalosporins, e.g.* *Ceftriaxone 500mg IM q24h for 10 days	Contact tracing: Examine and investigate sex partner and treat when indicated *Reference: British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2006

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Secondary Syphilis Incubation period: 6-8 weeks	As above	As above	Contact tracing
Early Latent Syphilis *Syphilis infection of less than 2 years duration.* Positive serology without symptoms and signs.	As above	As above	Contact tracing
Late Latent Syphilis Syphilis infection of more than 2 years duration	Procaine Penicillin 600,000 units IM q24h for 17 days **OR** Benzathine Penicillin 2.4 mega units IM weekly for 3 weeks	If allergic to penicillin: Doxycycline 100mg PO q12h for 28 days **OR** Tetracycline 500mg PO q6h for 28 days **OR** EES 800mg PO q12h for 28 days **OR** *Amoxycillin 2g PO q8h **PLUS** Probenecid 500mg PO q6h for 28 days	Contact tracing *<u>Reference:</u> British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2006

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Neurosyphilis	Benzylpenicillin 3-4 mega units IV q4h for 14 days **OR** Procaine Penicillin 2.4 mega units IM q24h **PLUS** Probenecid 500mg PO q6h for 17 days	If allergic to penicillin: *Doxycycline 200mg PO q12h for 28 days **OR** *Amoxycillin 2g PO q8h **PLUS** Probenecid 500mg PO q6h for 28 days	Repeat CSF examinations every 6 months. Consider retreatment if cell count is not decreased in 6 months or CSF is not entirely normal in 2 years (Ref: MMWR 1998; 47, RR-1) All patients with neurosyphilis should be considered for corticosteroid cover at the start of the therapy to prevent the Jarisch-Herxheimer reaction (Prednisolone 10-20mg PO q8h for 3 days commencing one day prior to syphilis treatment) *Reference: British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2006
Syphilis in HIV Primary, secondary, early and late latent, and of unknown duration	Treat as for non-HIV patients with neurosyphilis	Treat as for non-HIV patients with neurosyphilis	CSF examination should be done

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Syphilis in Pregnancy	As in non-pregnant patients with syphilis	Use Erythromycin as in non-pregnant patients with syphilis	Tetracycline and Doxycycline are contraindicated in pregnancy Erythromycin can be used, but has a high risk of failure to cure the infection in infants. Therefore, all infants should be treated at birth
Congenital Syphilis	Benzylpenicillin 100,000-150,000 units/kg/day, administered as 50,000 units/kg/dose IV q12h during the first 7 days of life and q8h thereafter for a total of 10 days **OR** Procaine Penicillin 50,000 units/kg/dose IM q24h for 10 days	If allergic to penicillin: No proven alternative therapy. Penicillin desensitisation may be required	If a non-penicillin agent is used, close serologic and CSF follow-up are indicated

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Gonorrhoea *Neisseria Gonorrhoeae*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 250mg IM stat **OR** Spectinomycin 2g IM stat	*3rd gen. Cephalosporins, e.g.* Cefotaxime 500mg IM stat **PLUS** Probenecid 1g PO stat **OR** Cefuroxime 1.5g IM stat **PLUS** Probenecid 1g PO stat **OR** Norfloxacin 800mg PO stat **OR** Ciprofloxacin 500mg PO stat **OR** Ofloxacin 400mg PO stat **OR** Azithromycin 1g PO stat (covers NSU as well)	Contact tracing Also treat for non-specific urethritis (NSU) in view of high incidence of coexisting NSU in patients with gonorrhoea

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Gonococcal Epididymitis/ Epididymo-orchitis	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 500mg IM q24h for 5-7 days	Spectinomycin 2g IM q24h for 5-7 days **PLUS** Doxycycline 100mg PO q12h for 14 days **OR** Spectinomycin 2g IM q24h for 5-7 days **PLUS** EES 800mg PO q12h for 14 days	Contact tracing
Disseminated Gonorrhoea	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IM/IV q24h **continued for 24-48 hours after improvement begins, then switch to:** Ciprofloxacin 500mg PO q12h **OR** Ofloxacin 400mg PO q12h	*3rd gen. Cephalosporins, e.g.* Cefotaxime 1g IV q8h **OR** Spectinomycin 2g IM q12h **OR** Ciprofloxacin 400mg IV q12h **OR** Ofloxacin 400mg IV q12h	Admit patient Contact tracing Duration of treatment depends on clinical response
Chlamydial/Non-Specific Urethritis (NSU)/Non-Specific Genital Infection in Women (NSGI)	Doxycycline 100mg PO q12h for 7 days	EES 800mg PO q12h for 7 days **OR** Ofloxacin 200mg PO q12h for 7 days **OR** Azithromycin 1g PO stat	Contact tracing Doxycycline and Ofloxacin are contraindicated in pregnancy

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Chancroid *Haemophilus Ducreyi*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 250mg IM stat **OR** Ciprofloxacin 500mg PO q12h for 3 days	EES 800mg PO q12h for 7 days **OR** Azithromycin 1g PO stat	Contact tracing
Lymphogranuloma Venereum *Chlamydia Trachomatis Serovar L1, 2, 3*	Doxycycline 100mg PO q12h for 21 days **OR** Tetracycline 500mg PO q6h for 21 days	Minocycline 100mg PO q12h for 21 days **OR** EES 800mg PO q12h for 21 days **OR** Azithromycin 1g PO weekly for 3 weeks	Contact tracing Final duration depends on clinical response
Granuloma Inguinale *Klebsiella Granulomatis*	Doxycycline 100mg PO q12h for 3 weeks **OR** Tetracycline 500mg PO q6h for 3 weeks	Minocycline 100mg PO q12h for 3 weeks **OR** Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3 weeks **OR** EES 800mg PO q12h for 3 weeks **OR** Ciprofloxacin 750mg PO q12h for 3 weeks **OR** Azithromycin 1g PO weekly for 3 weeks or 500mg PO q24h for 7 days	Contact tracing Add Gentamicin[1] 1.5mg/kg IM/IV q8h in patients whose lesions do not respond in the first few days to other agents Duration of treatment should be until lesions have healed. Healing times vary greatly between patients. A minimum of 3 weeks treatment is recommended

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Trichomoniasis *Trichomonas Vaginalis*	Refer to Page 71 Obstetrics & Gynaecology Infections)		
Bacterial vaginosis *Gardnerella Vaginalis, Anaerobes*	Refer to Page 71 (Obsetrics & Gynaecology Infections)		
Herpes Genitalis *Herpes Simplex Virus 1 and 2*	First episodic: Acyclovir 200mg PO 5 times a day for 5 days Recurrent - episodic: Acyclovir 200mg PO 5 times a day for 5 days Suppressive therapy: (may be indicated if ≥6 recurrences per year) Acyclovir 400mg PO q12h or 200mg PO 4 times a day for up to 1 year, then reassess		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

References:

1. British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2006
2. Center for Disease Control and Prevention, Sexually Transmitted Diseases Treatment Guidelines 2006. MMWR 2006 Aug; Vol. 55, RR-11
3. European STD Guidelines. Int J STD AIDS 2001 Oct. 12 Suppl 3:2-3

SKIN AND SOFT TISSUE INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Bacterial Infections			
Impetigo/Ecthyma *S. Aureus* *S. Pyogenes*	Cloxacillin 500mg PO q6h for 5-7 days	EES 800mg PO q12h for 5-7 days **OR** Cephalexin 500mg PO q6h for 5-7 days **OR** Azithromycin 500mg PO q24h for 3-5 days	References: 1. Australian Medicines Handbook 2006 (revised July 2006) 2. Cambridgeshire GP antibiotic Guidelines from NHS Primary Care Trust. Reviewed: Sept 2006 3. Practice guidelines for the diagnosis and management of skin and soft-tissue infections. Clinical Infectious Diseases 2005; 41:1373-1406
Boils/Carbuncles *S. Aureus*	Cloxacillin 500mg PO q6h for 7-10 days	EES 800mg PO q12h for 7-10 days **OR** Cefuroxime 500mg PO q12h for 7-10 days **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 7-10 days	Surgical drainage is important in the management Reference: Australian Medicines Handbook 2006 (revised July 2006)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Cellulitis/Erysipelas *Strep Pyogenes* *Staph Aureus*	Cloxacillin 1g IV q6h Change to oral (Cloxacillin 1-2g q6h) once condition improves	Cefazolin 1g IV q8h **OR** EES 800mg PO q12h **OR** Cephalexin 500mg PO q6h *Change to oral once condition improves*	References: 1. Australian Medicines Handbook 2006 (revised July 2006) 2. Cambridgeshire GP antibiotic Guidelines from NHS Primary Care Trust. Reviewed: Sept 2006
Diabetic Foot Infections	Refer to Page 123 (Bone & Joint Infections)		
Gas Gangrene/Myonecrosis/ Necrotizing Fasciitis *Streptococci* *Clostridium sp.* *Polymicrobial*	Refer to Page 123 (Bone & Joint Infections)		
Yaws *Treponema Pertenue*	Benzathine Penicillin 2.4 mega units IM single dose If allergic to penicillin: Tetracycline 500mg PO q6h for 15 days **OR** EES 800mg PO q12h for 15 days	Doxycycline 100mg PO q12h for 15 days	Reference: Fitzpatrick's Dermatology in General Medicine Vol II Sixth Edition

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Mycobacterial Infections			
Hansen's Disease (Leprosy) Mycobacterium Leprae	**Sg. Buloh Augmented Regime** ***Paucibacillary*** Rifampicin 600mg PO monthly (supervised) **PLUS** Dapsone 100mg PO q24h **PLUS** Clofazimine 50-100mg PO q24h Duration: 1 year Surveillance: BI/MI annually for 5 years ***Multibacillary*** Intensive phase: Rifampicin 600mg PO q24h **PLUS** Dapsone 100mg PO q24h **PLUS** Clofazimine 100mg PO q24h Duration: 3 weeks (or till MI=0)	**WHO Regime** ***Paucibacillary*** (1-5 skin lesions) Rifampicin 600mg PO monthly **PLUS** Dapsone 100mg PO q24h Duration: 6 months ***Multibacillary*** (>5 skin lesions) Rifampicin 600mg PO monthly **PLUS** Dapsone 100mg PO q24h **PLUS** Clofazimine 300mg PO monthly and 50mg q24h Duration: 1 to 2 years	References: 1. Guidelines for M.D.T. 1991 by Dr. T. Ganesapillai 2. World Health Organisation health guidelines

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Maintenance phase: Rifampicin 600mg PO monthly **PLUS** Dapsone 100mg PO q24h **PLUS** Clofazimine 300mg PO monthly and 50-100mg q24h Duration: 3 years For those with BI>3, treat till smear negative Surveillance: BI/MI annually for 10 years	***Single skin lesion paucibacillary leprosy*** Single dose of: Rifampicin 600mg PO **PLUS** Ofloxacin 400mg PO **PLUS** Minocycline 100mg PO **Bacterial resistance or hypersensitivity to first line** Can be substituted with one of the following: Minocycline 100mg PO q24h Ofloxacin 400mg PO q24h Clarithromycin 500mg PO q24h Ethionamide 250mg PO q24h	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Atypical Mycobacterial Infections *Mycobacterium Marinum*	Clarithromycin 500mg PO q12h **PLUS** Minocycline/Doxycycline 100mg PO q12h **OR** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h For 4-6 months, and continue for at least 1 month after lesions have been cleared	Rifampicin 600mg PO q24h **PLUS** Ethambutol 15mg/kg PO q24h for 4-6 months, and continue for at least 1 month after lesions have been cleared	No available consensus guidelines Only case reports
Mycobacterium Kansasii	Isoniazid 300mg PO q24h **PLUS** Rifampicin 600mg PO q24h **PLUS** Ethambutol 15mg/kg PO q24h for 18 months		
Mycobacterium Ulcerans	Amikacin[1] 15mg/kg IV q24h **PLUS** Clarithromycin 500mg PO q12h		Wide surgical excision and debridement are important
Mycobacterium Fortuitum/Chelonei	Doxycycline/Minocycline 100mg PO q12h **PLUS** Clarithromycin 500mg PO q12h		Surgical debridement is important

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	OR Amikacin[1] 15mg/kg IV q24h **PLUS** Clarithromycin 500mg PO q12h For 4-6 months, and continue for at least 1 month after lesions have been cleared		
Fungal Infections			
Tinea Capitis / **Tinea Barbae** *Trichophyton, Microsporum*	Griseofulvin 10-15mg/kg/24h PO **OR** 500mg q12h or q24h for 6 weeks	Terbinafine 250mg PO q24h **OR** Itraconazole 200mg PO q24h for 2-6 weeks	Reference: Australian Medicines Handbook 2006 (revised July 2006)
Tinea Corporis / **Tinea Cruris /** **Tinea Faciei** *Trichophyton, Microsporum, Epidermophyton*	Mild infections: Topical imidazole cream: Clotrimazole 1% **OR** Miconazole 2% **OR** Tioconazole 1% Duration: 4 weeks Extensive infections: Griseofulvin 500mg PO q12h or q24h for 4-6 weeks	Terbinafine 250mg PO q24h for 2 weeks **OR** Itraconazole 200mg PO q24h for 2 weeks	Reference: Australian Medicines Handbook 2006 (revised July 2006)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Tinea Manuum/ Tinea Pedis *Trichophyton, Microsporum, Epidermophyton*	Griseofulvin 500mg PO q12h for 6-12 weeks **OR** Itraconazole 200mg PO q24h for 2-4 weeks	Terbinafine 250mg PO q24h for 2-4 weeks	
Tinea Unguium *Trichophyton, Microsporum, Epidermophyton*	Terbinafine 250mg PO q24h For 6 weeks (finger nails) For 12 weeks (toe nails) **OR** Pulse Itraconazole 200mg PO q12h for 1 week per month For 2 months (finger nails) For 3 months (toe nails)	Griseofulvin 500mg PO q12h For 6 months (finger nails) For 12 months (toe nails) **OR** Amorolfine 5% Nail Lacquer weekly application For 6 months (finger nails) For 12 months (toe nails)	Reference: Australian Medicines Handbook 2006 (revised July 2006)
Tinea Versicolor *Malassezia Furfur* *Pityrosporum Orbiculare*	Selenium Sulphide 2% shampoo apply to affected areas 20-30 minutes before bathing **OR** Dilute to 1:1 with water, apply and leave overnight (treat for 1-2 weeks) For face: Topical Imidazole for 4-6 weeks e.g. Miconazole 2% cream, Clotrimazole 1% cream, Tioconazole 1% cream	Itraconazole 200mg PO q24h for 1 week **OR** Ketoconazole 200mg PO q24h for 1 week	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Candidiasis *Candida Albicans*	**Mild cutaneous candidiasis:** Topical Imidazole q12h till clear e.g. Miconazole 2% cream, Clotrimazole 1% cream, Tioconazole 1% cream **Extensive cutaneous candidiasis:** Itraconazole 200mg PO q24h for 1 week **OR** Fluconazole 100mg PO q24h for 1 week **Oral candidiasis:** Nystatin suspension 500,000 units PO q6h for 2 weeks **Vaginal candidiasis:** Refer to Page 71 (Obstetrics & Gynaecology Infections)	**Oral candidiasis:** Fluconazole 100mg PO q24h For 1-2 weeks (if severe) **Vaginal candidiasis:** Refer to Page 71 (Obstetrics & Gynaecology Infections)	Treatment of sexual partner is advisable in case of recurrent infection.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Subcutaneous Fungal Infections			
1 Sporotrichosis	Itraconazole 200mg PO q12h for 4-6 months and continue for at least 1 month after recovery	Terbinafine 250mg PO q24h for 4-6 months and continue for at least 1 month after recovery **OR** Potassium iodide (saturated solution 50mg/drop) PO 500-1500mg/day, increase to 4000-6000mg/day in 3 divided doses for 6-10 weeks	In some immunocompromised condition such as AIDS, longer treatment maybe necessary. Refer to Page 53 (Opportunistic Infections In HIV Patients)
2. Chromomycosis, Eumycetoma	Itraconazole 200mg PO q12h for 4-6 months and continue for at least 1 month after recovery		
3. Cryptococcosis	Fluconazole 200-400mg IV/PO q24h for 2 weeks (in ill patients initial therapy with IV Amphotericin B is preferred)	Amphotericin B IV 0.6-1mg/kg q 24h	
4. Histoplasmosis, Penicilliosis, etc.	Itraconazole 200mg PO q12h for 2-4 months or till lesions healed, then 200mg q24h for 1-2 months (in ill patients initial therapy with IV Amphotericin B is preferred)	Amphotericin B IV 0.6-1mg/kg q24h	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Viral Infections			
Herpes Simplex Infections	**Oral:** Primary: Acyclovir 200-400mg PO 5 times daily for 5 days Recurrent: Regular normal saline dabs/gargle In immunocompromised patients. Refer to Page 53 (Human Immunodeficiency Virus) **Genitalia:** *(Refer to Page 100 Sexually Transmitted Infections)* **Eczema herpeticum:** Acyclovir 200mg PO 5 times daily for 7-10 days	Severe cases: Acyclovir 5mg/kg IV q8h for 5 days or until able to take orally, then change to oral	
Chickenpox *Varicella Zoster*	Immunocompetent: Acyclovir 800mg PO 5 times daily for 1 week Immunocompromised/disseminated: Acyclovir 10mg/kg IV q8h for 1 week (change to oral once there is an improvement)		Advisable to start treatment early within 48 hours Reference: Infectious Diseases Society of America Guidelines 2005

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Herpes Zoster *Varicella Zoster*	Acyclovir 800mg PO 5 times daily for 1 week*		*Only indicated in immunocompromised patients, herpes zoster ophthalmicus, Ramsay-Hunt syndrome and the elderly Advisable to start treatment early within 48 hours
Parasitic Infestations			
Scabies *Sarcoptes Scabeii*	Benzyl Benzoate emulsion 25% (EBB) apply from neck down and leave for 24 hours for 2 days	Gamma Benzene Hexachloride 1% (Lindane) apply and leave for 8 hours (not to be repeated in less than a week) **OR** Permethrin 5% cream apply and leave for 8 hours **Pregnant women:** Sulphur 6% in calamine lotion apply q12h **OR** Crotamiton (Eurax) cream apply q12h for 2-3 weeks **OR** Permethrin 5% cream apply and leave for 8 hours	<u>References:</u> 1. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines 2006 2. David Flinders. American Academy of Family Physicians 2003

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Head Lice *Pediculus Humanus Capitis*	Gamma Benzene Hexachloride 0.1% (Lindane) apply and leave for 8 hours	Malathion 1% shampoo	
Body Lice/pubic Lice *Pediculus Humanus*	As for Head Lice		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

SURGICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
A. GENERAL SURGERY			
Appendicitis *Enterobacteriaceae Enterococci, Bacteroides*	Ampicillin 500mg IV q4-6h **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q6-8h **OR** Amoxycillin/Clavulanate 1.2g IV q8h	Start upon diagnosis, discontinue after surgery
Perforated Appendix, Appendicular Mass	Metronidazole 500mg IV q8h **PLUS** *3rd gen. Cephalosporins, e.g.* Cefoperazone 2-4g/day IV in divided doses q12h	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q6-8h **OR** Amoxycillin/Clavulanate 1.2g IV q8h	Duration 5-7 days
Perforated Viscus Peritonitis	Ampicillin 500mg IV q6h **PLUS** Metronidazole 500mg IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h **OR** *3rd gen. Cephalosporins, e.g.* Cefoperazone 2-4g/day IV in divided dose q12h **PLUS** Metronidazole 500mg IV q8h	Cefoperazone/Sulbactam 1-2g q12h, up to maximum 8g/day **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q6-8h **OR** Amoxycillin/Clavulanate 1.2g IV q8h	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Abdominal trauma Suspected bowel or solid organ injury *Gram negative enteric aerobes and anaerobes*	Cefuroxime 1.5g IV q8h **OR** *3rd gen. Cephalosporins, e.g.* Cefotaxime 1g IV q8h **OR** Cefoperazone 1g IV q12h	Cefoperazone/Sulbactam 1g IV q12h **PLUS** Metronidazole 500mg IV q8h **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q8h **OR** Amoxycillin/Clavulanate 1.2g IV q8h	Duration - min 5 days
Breast Abscess *Staph Aureus*	Cloxacillin 1g IV q6h		Drainage may be required
VASCULAR			
Mycotic Pseudoaneurysm in IVDU	Cloxacillin 2g IV q6h	Based on C&S	Initial therapy is high dose IV followed by oral therapy once debridement and ligation done. The duration will depend on clinical response

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Prosthetic Graft Infection Non-*MRSA* *MRSA*	*3rd gen. Cephalosporins, e.g.* Cefotaxime 1g q8h **OR** Cefoperazone 2-4g/24h IV in two divided doses Vancomycin[1] 1g IV q12h	Based on C&S Linezolid 600mg IV q12h	Duration may need to be prolonged if graft salvage considered Vancomycin levels need to be monitored. Graft may need to be explanted
Ischaemic Ulcers	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h IV **OR** Ampicillin/Sulbactam 375mg PO q12h	Based on C&S	Given IV if diabetes present Refer Page 123 (Bone & Joint Infections)
BITES (penetrating injuries)			
Animal bite *S. Aureus, Strep.,* *Gram -ve Bacilli,* *Anaerobes*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h	If severe, Cefuroxime 750mg IV q8h	Consider IV for severe cases Duration 3-5 days. If infected: 10 days

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Human bite *S. Aureus, Anaerobes, Eikenella*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h	If allergic to Penicillin, Clindamycin 300mg PO q6h **PLUS** Ciprofloxacin 500-750mg PO q12h **OR** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h	Duration 3-5 days Delay or do not suture
B. BONE AND JOINT INFECTIONS			
Septic Arthritis *Staph. Aureus*	Cloxacillin 1-2 g IV q6h	If Penicillin allergy (immediate hypersensitive type) Clindamycin 300-600mg IV q8h followed by oral therapy (same dose)	Drainage, debridement and washout of infected joint is important to limit further damage Empirical therapy wherever possible should be directed by the result of the Gram stain of the joint aspirate If initial gram stain is gram positive cocci use: ◆ Cloxacillin If initial gram stain is gram negative bacilli use: ◆ *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV daily

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
OSTEOMYELITIS			
Acute Osteomyelitis *S. Aureus* (80%), *Group A Strep Pyogenes*, rarely gram negative Bacilli	Cloxacillin 1-2g IV q6h **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h if gram negative bacilli on gram stain	If Penicillin allergy (immediate hypersensitive type) Clindamycin 300-600mg IV q8h followed by oral therapy (same dose)	Duration: Initial IV therapy for 2-4 weeks followed by oral therapy. Minimum 6 weeks. Modify according to clinical response
Chronic Osteomyelitis (after 3 months of appropriate antibiotic therapy or presence of dead bone on x-ray) Commonest *S. Aureus*	Empirical treatment is not indicated Thorough Surgical debridement required (Removal of dead bone/ orthopaedic hardware) Choice of antibiotic depends on C&S result from tissue/bone		Surgical debridement if necessary Minimum length 6 weeks but usually > 3 months Treat until inflammatory parameters are normal
Diabetic Foot Infections Antibiotics should not be used unless there are local or systemic symptoms of infection. Local treatment including surgical debridement is important. Antibiotic selection should be based on the most recent culture and sensitivity report.			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Mild Infections: *Presence of > 2 markers of inflammation (purulence or erythema, pain, tenderness, warmth, or induration) with any cellulitis/erythema extending less than 2 cm around the ulcer; infection is limited to the skin or superficial subcutaneous tissues; no systemic toxicity*	Cloxacillin 500mg PO q6h **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h	Cephalexin 500mg PO q6h **OR** Clindamycin 300-450mg PO q6	Duration of treatment: 1-2 weeks
Moderate Infections: Features of mild infection, no systemic toxicity or metabolic instability and > 1 of the following: cellulitis extending more than 2 cm around an ulcer, lymphangitic streaking, spread beneath the superficial fascia, deep tissue abscess, gangrene, or involvement of muscle, tendon, joint, or bone	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5-3g IV q8h **OR** *2nd or 3rd gen. Cephalosporins, e.g.* Cefuroxime 750mg-1.5g IV q8h **OR** Ceftriaxone 1-2g q24h **PLUS/MINUS** Metronidazole 500mg IV q8h	Ciprofloxacin 500-750mg PO q12h **OR** Clindamycin 300-450mg PO q6h If antibiotic-resistant organisms are likely, treat as severe infection	Duration of treatment: usually 2-4 weeks. Modify according to clinical response If proven osteomyelitis: at least 4-6 weeks. However, a shorter duration (3 weeks) is sufficient if the entire infected bone is removed

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Severe Infections: *Infection plus systemic toxicity or metabolic instability (e.g. fever, chills, tachycardia, hypotension, confusion, vomiting, leukocytosis, metabolic acidosis, severe hyperglycemia, or azotemia above baseline)*	Piperacillin/Tazobactam 4.5g IV q6-8h **OR** *3rd gen. Cephalosporins, e.g.* Ceftazidime 2g IV q8h **PLUS** Metronidazole 500mg IV q6h	Imipenem/Cilastatin 500mg IV q6h	Add Vancomycin[1] 1g IV q12h, if high risk for MRSA Duration of treatment: as in moderate infection Necrotizing fascitis
Necrotizing Fascitis			
Type 1 Polymicrobial infection. Primarily occurs in patients who are immunocompromised or have certain chronic diseases such as diabetes	Cloxacillin 2g IV q4-6h **PLUS** Metronidazole 500mg IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h	*3rd gen. Cephalosporins* **PLUS** Metronidazole 500mg IV q8h **OR** *β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q8h **OR** Amoxycillin/Clavulanate 1.2g IV q8h **PLUS/MINUS** Gentamicin[1] 5mg/kg IV q24h	Early aggressive surgical debridement essential

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Type 2 *Group A strep*	Benzylpenicillin 2-4 mega units IV q4h **PLUS** Clindamycin 600mg IV q8h		Suspect Group A Strep if Gram stain shows Gram positive cocci in chains Early aggressive surgical debridement essential
Soft Tissue Infection Secondary To Gas Producing Organism			
e.g. Clostridium spp, *Gram -ve org*	*Benzylpenicillin 2-4 mega units IV q4h **PLUS** Metronidazole 500mg IV q8h **PLUS/MINUS** Gentamicin[1] 5mg/kg IV q24h	*3rd gen. Cephalosporins* **PLUS** Gentamicin[1] 5mg/kg IV q24h Depends on culture & sensitivity	*For Clostridium sp.: Benzylpenicillin 4 mega units q6h is preferred Early aggressive surgical debridement essential
Suppurative Wound Infections, Surgical Or Traumatic			
Suppurative wound infections, surgical or traumatic	If there is surrounding cellulitis and/or systemic symptoms are present: Cloxacillin 500mg PO/IV q6h If gram negative organisms suspected or known to be involved: Gentamicin[1] 5mg/kg IV q24h **OR** As a monotherapy: Cefuroxime 1.5g IV q8h	Change antibiotics accordingly after trace culture and sensitivity result	Topical antibiotics are not recommended for treatment of wound infections as it may result in the emergence of resistant organisms Patient tetanus immunisation status should be assessed in all cases

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Muscular, Skeletal and Soft Tissue Trauma, Crush Injuries and Stab Wounds			
Muscular, skeletal and soft tissue trauma, crush injuries and stab wounds	Cloxacillin 2g IV q6h **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h Duration: Not less than 5 days	Cefuroxime 1.5g as a loading dose, followed by 750mg IV q8h **PLUS** Metronidazole 500mg IV q8h Duration: Not less than 5 days	Thorough surgical debridement, soft tissue and fracture stabilisation For severe penetrating injuries, especially those involving joints and/or tendons, antibiotics must be given for at least 5 days
Compound Fractures			
Compound fractures	Cloxacillin 1g IV q6h **OR** Cefuroxime 1.5g IV q8h If wound soiling or tissue damage is severe and/or devitalized tissue is present: **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h Duration: 5-10 days		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
C. UROLOGY			
Pyonephrosis/Perinephric Abscess *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h **OR** *3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h	Ciprofloxacin 200-400mg IV q12h	**PLUS** Drainage followed by definitive surgery
Renal Abscess *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas, Staph Aureus*	*β-lactam/β-lactamase inhibitors, e.g.* Ampicillin/Sulbactam 1.5g IV q8h followed by 375mg PO q12h **OR** Cefuroxime 750mg IV q8h followed by 250mg PO q12h **PLUS/MINUS** Gentamicin[1] 5mg/kg IV q24h Minimum of 2 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h	Drainage may be required. Commence oral after temperature settled

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute Prostatitis *E. Coli* *Staph Saprophyticus* *Enterococus* *Enterobacteriacie* *Proteus*	If ill and hospitalised Ciprofloxacin 200mg IV q12h **PLUS/MINUS** Gentamicin[1] 5mg/kg IV q24h Less Severe infection: Ciprofloxacin 500mg PO q12h	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h Trimethoprim/Sulfamethoxazole 160/800mg PO q12h **OR** Trimethoprim 300mg PO q24h	Treatment for 4 weeks
Chronic Bacterial Prostatitis (CPPS NIH Type II) *Mostly culture negative*	Ciprofloxacin 500mg PO q12h for 2 weeks Then reassess, if beneficial to continue for 4-6 weeks	Trimethoprim/Sulfamethoxazole 160/800mg PO q24h for 2 weeks Then reassess, if beneficial to continue for 4-6 weeks	Pending positive culture on prostatic secretion
Prostatic Abscess *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Ciprofloxacin 200-400mg IV q12h followed by 500mg PO q12h minimum of 2-4 weeks	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h followed by, Cefuroxime 500mg PO q12h minimum of 2-4 weeks	Drainage mandatory

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Non Gonoccocal Urethritis			Refer to Page 100 (Sexually Transmitted Infections)
Epididymo-orchitis *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Doxycycline 100mg PO q12h minimum of 2 weeks	Ciprofloxacin 500mg PO q12h minimum of 2 weeks	
Testicular Abscess *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h	**PLUS** drainage
Fournier's Gangrene *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas, Anaerobes*	*3rd gen. Cephalosporins, e.g.* Cefoperazone 1g IV q12h **PLUS** Metronidazole 500mg IV q8h	Cefoperazone/Sulbactam 1g IV q12h **PLUS** Metronidazole 500mg IV q8h	**PLUS** debridement
Urosepsis **(Septicaemia post urological instrumentation or urological infections)** *E. Coli, Klebsiella, Proteus, Enterococcus, Pseudomonas, MRSA*	Cefepime 1g IV q12h **OR** Imipenem/Cilastatin 500mg IV q8h	Cefoperazone/Sulbactam 1g IV q12h	Choice of antibiotics should be adapted based upon culture results

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
D. NEUROSURGERY			
Brain Abscess			
Contiguous source of infection Paranasal sinuses Otogenic infection	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12h **PLUS** Metronidazole 500mg IV q8h	*3rd gen. Cephalosporins, e.g.* Cefotaxime 2g IV q6h **PLUS** Metronidazole 500mg IV q8h	Usual treatment for uncomplicated infection is 7-14 days, for complicated is 6-8 weeks
Postoperative	Cloxacillin 2g IV q4h	Vancomycin[1] 1g IV q12h (MRSA) **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12h	
Post-traumatic	Cloxacillin 2g IV q4h **PLUS** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12h		
Source of infection unknown	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV q12h **PLUS** Metronidazole 500mg IV q8h **PLUS/MINUS** Cloxacillin 2g IV q4h	Vancomycin[1] 1g IV q12h (MRSA) **PLUS** Metronidazole 500mg IV q8h	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Penetrating craniocerebral injuries (PCCI) and depressed fractures including ***base of skull fracture***	Cefuroxime 1.5g IV stat dose followed by 750mg IV q8h **PLUS** Metronidazole 500mg IV q8h **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g q8h IV/625mg PO q12h	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 2g IV stat followed by 1g IV q12h **PLUS** Metronidazole 500mg IV q8h	For 5 days
Open scalp laceration	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h/625mg PO q12h	Cloxacillin 1-2g IV q6h	For 5 days

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

TROPICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. Management of Typhoid Fever			
Stable Case Fully sensitive	Pefloxacin 400mg PO q12h for 5-7 days **OR** Ciprofloxacin 750mg PO q12h for 5-7 days **OR** Levofloxacin 500mg PO q24h for 5-7 days	Ampicillin 500mg PO q6h for 14 days **OR** Chloramphenicol 500mg PO q6h for 14 days **OR** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h for 14 days	WHO, 2003 Fever clearance is faster with Quinolones
Stable Case Multidrug resistance (Resistance to CMC, Ampicillin and TMP-SMX)	Ciprofloxacin 500mg PO q12h for 5-7 days	Azithromycin 500mg PO q24h for 7 days	WHO, 2003
Quinolone resistance	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 3g IV q24h for 10-14 days **OR** Azithromycin 500mg PO q24h for 7 days		WHO, 2003

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Unstable or complicated cases	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 3g/24h IV for 7-10 days **OR** Ciprofloxacin 200mg IV q12h for 7-10 days		Indication of Dexamethasone (discuss with physician) i) Thyphoid psychosis ii) Sepsis with shock Dose: 3mg/kg loading. Followed by 1mg/kg q6h for 2 days WHO, 2003 Paed. Inf. Dis J,1988
2. Management of Cholera			
Non Tetracycline resistance *Tetracycline resistance*	Doxycycline 300mg PO stat (once patient can take orally) EES 400mg PO q12h for 3 days (The only option in pregnancy)	Ciprofloxacin 1g PO stat Ciprofloxacin 1g PO stat	Principle of Treatment: i) Rehydration ORS if tolerating orally ii) Monitor urine output iii) Avoid antidiarrhoea agents - Diphenoxylate HCL/Atropine Sulphate (Lomotil) or Loperamide HCL (Imodium) WHO Global Task on Cholera Control 2004

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
3. Management of Scrub Typhus			
Scrub Typhus (Orientia tsutsugamushi)		Chloramphenicol 500mg PO q6h for 3-7 days **OR** Azithromycin 500mg PO stat (mild scrub typhus)	Pregnancy: Azithromycin 500mg PO stat CID 2004 Nov 1; 39(9):1329-35
Tetracycline sensitive	Doxycycline 200mg PO q24h for 3-7 days	Rifampicin 900mg PO q24h for 7 days	
Reduced susceptibility to Tetracycline	Azithromycin 500mg PO stat (mild scrub typhus)		
4. Management of Brucellosis			
Brucellosis *B. Melitensis, B. Abortus, B. Suis and B. Canis*	Doxycycline 100mg PO q12h **PLUS** Rifampicin 600-900mg (15mg/kg) PO q24h for 6 weeks; **OR** Doxycycline 100mg PO q12h for 6 weeks **PLUS** Gentamicin[1] 1.5mg/kg IV q8h for 7 days	Ofloxacin 400mg PO q24h **PLUS** Rifampicin 600-900mg PO q24h for 6 weeks; **OR** Rifampicin 900mg PO q24h **PLUS** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h for 6 weeks	Pregnancy: Rifampicin 900mg PO q24h CID 42:10752006 NEJM 352; 2005

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
5. Management of Leptospirosis			
Severe disease (Leptospiral pulmonary syndrome, multiorgan involvement, sepsis)	Benzylpenicillin 2.4 mega units IV q6h for 7 days; **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 1g IV q24h for 7 days	*3rd gen. Cephalosporins, e.g.* Cefotaxime 1g IV q8h for 7 days	Clin Infect Dis 2003; 36:1507-1513 Clin Infect Dis 2004; 39:1417-1424
Mild to Moderate disease	Benzylpenicillin 2.4 mega units IV q6h for 7 days	Doxycycline 100mg PO q12h for 7 days **OR** Azithromycin 500mg PO q24h for 7 days	Reference: Clin Infect Dis 2003; 36:1514-1515
6. Management of Tetanus			
Clostridium Tetani	Metronidazole 500mg IV q6h for 7-10 days	Erythromycin 1g IV q6h **OR** Clindamycin 600mg IV q6h for 10 days	(Penicillin, a GABA antagonist, may aggravate the spasms)
Toxin neutralisation (if visible point of entry)	Human Tetanus Immunoglobulin 3000 to 6000 iu IM		A single 500-iu dose of human immunoglobulin may be as effective

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
7. Management of Melioidosis			
Melioidosis *Burkholderia Pseudomallei*	**Initial Therapy** *3rd gen. Cephalosporins, e.g.* Ceftazidime 120mg/kg/24h IV q6-8h **PLUS/MINUS** Trimethoprim/Sulphamethoxazole 8/40mg/kg/24h IV for 2-3 weeks **Maintenance Therapy** Trimethoprim/Sulphamethoxazole 10/50mg/kg/24h PO **PLUS** Doxycycline 100mg PO q12h Duration minimum 20 weeks	Cefoperazone/Sulbactam 2g IV q8h **PLUS/MINUS** Trimethoprim/Sulphamethoxazole 8/40mg/kg/24h IV for 2-3 weeks **OR** Imipenem 500-750mg IV q6h for 2-3 weeks *β-lactam/β-lactamase inhibitors, e.g.* * Amoxycillin/Clavulanate 1250mg (2 tablets of 625mg) PO q8h **OR** Trimethoprim/Sulphamethoxazole 8/40mg/kg/24h Duration minimum 20 weeks	Reference: Clinical Microbiology Reviews, Apr 2005, p. 383-416 Look for source of infection Antimicrobial Agents and Chemo, Oct 2005, 4020-4025 *Well tolerated and has better adverse effect profile than the conventional regimen (Doxycycline & Trimethoprim/Sulphamethoxazole) but it is associated with a higher relapse rate

8. Malaria (Ref: 1) WHO malaria guidelines 2006
2) CDC: Malaria (Prescription drugs for Malaria updated Feb 2007)

WHO recommended combination therapies on the basis of the available safety and efficacy data

Risk group:
Pregnancy
Children < 5 years old
Severe vomiting, headache
BFMP: parasites >100,000/ul or BFMP ++++

Features of severe/complicated Malaria includes at least one of the following:

Clinical manifestation:
Prostration
Impaired consciousness -GCS <15
Respiratory distress (acidotic breathing)
Multiple convulsions
Pulmonary oedema (radiological)
Abnormal bleeding
Jaundice
Shock/Algid malaria
Haemoglobinuria- coffee coloured urine

Laboratory test:
Acute Renal Failure (Sr creatinine >265umol/l)
Metabolic acidosis- HCO3 <15mmol/l
Hyperlactatemia; serum lactate >5mmol/l
Hepatic dysfunction
Hyperparasitemia
Hypoglycaemia
Severe anaemia
DIVC

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Malaria			
Plasmodium Falciparum **a) Non Complicated** i) New Infection	***Adult (>35kg)*** D1-D3: (Artequin) Artesunate 200mg/day Mefloquine 500mg/day **Adult (<35kg)** D1-D3: (Artequiner®) Artesunate 100mg q24h Mefloquine 250mg q24h **OR** Riamet® (1 tablet: 20mg artemether/120mg lumefantrine) **Adult (>35kg)** D1: 4 tablets stat then again 4 tablets at 8 hours later D2-3: 4 tablets q12h (am, pm) (total course =24 tablets) **Adult (<35kg)** D1: 3 tablets stat then again 3 tablets at 8 hours later D2-3: 3 tablets q12h (am, pm) (total course = 18 tablets)	Quinine 10mg/kg PO q8h **PLUS/MINUS** Doxycline 100mg PO q12h for 7 days	The choice of drug should be governed by drug availability and safety. Artemesinin derivatives are contraindicated in pregnancy; use quinine If gametocytes continue to be present at D7 onwards, Primaquine 30mg as a single dose may be given (check G6PD status before use). Patient may be discharged home

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
ii) Treatment Failure	Artemether/Lumefantrine (as above) **PLUS** Doxycycline 100mg PO q12h for 7 days	Quinine 10mg/kg PO q8h **PLUS** Doxycycline 100mg PO q12h for 7-10 days	Mefloquine should not be taken for a second time within 28 days (neuropsychiatric side effects) **In pregnancy:** Quinine 10mg/kg PO q8h **PLUS** Clindamycin 600mg PO q12h for 7-10 days
b) Complicated (see definition above)	**D1:** Artesunate 2.4mg/kg IV stat then second dose 1.2mg/kg at 12 hours **D2-D7:** Artesunate1.2mg/kg IV q24h **OR** **D1:** Quinine 7mg/kg IV in 100ml N/S over 1 hour then 10mg/kg in 250-500ml D5% over 4 hours Then: Quinine 10mg/kg IV q8h (can give orally if tolerated) **PLUS** Doxycycline 100mg PO q12h for 7 days	**D1:** Loading dose Quinine IV 20mg/kg over 4 hours in D5% Then: Quinine 10mg/kg IV q8h (can give orally if tolerated) **PLUS** Doxycycline 100mg PO q12h for 7 days	Patient should be managed in an intensive care facility. Monitor patient's blood glucose and ECG while on IV quinine **In pregnancy:** Use Quinine IV regime and Clindamycin 600mg q12h as a substitute to Doxycycline **In renal failure:** Use 1/2-1/3 of the dose of Quinine. May maintain normal dose if patient receives dialysis. Watch out for toxicity

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Plasmodium Vivax or Ovale	Chloroquine 10mg/kg (max 600mg) stat then 5mg/kg (max 300mg) 6 hours later, D2 and D3 **PLUS** Primaquine 15mg/day PO for 14 days	Treatment failure: Repeat Chloroquine as first line **PLUS** Primaquine 15mg PO q12h for 14 days	Usually benign presentation. Check G6PD before starting Primaquine as it may cause haemolysis in G6PD deficient
Plasmodium Malariae/Knowlesi	Chloroquine 10mg/kg (max 600mg) stat then 5mg/kg 6 hours later, D2 and D3	Severe cases: Treat as complicated Plasmodium Falciparum	
Mixed Infection	Treat as Plasmodium Falciparum (see above)		
Chemoprophylaxis	Mefloquine 250mg weekly (up to 1 year)	Doxcycline 100mg q24h (up to 3 months)	To start 1 week before and continued till 4 weeks after leaving the area

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

MANAGEMENT OF TUBERCULOSIS

(Adapted from Practice Guidelines For The Management of Tuberculosis, Ministry of Health Malaysia, 2nd edition 2002)

1. Drugs

Five drugs are considered essential (1st line) for the treatment of tuberculosis. These are Isoniazid (H), Rifampicin (R), Pyrazinamide (Z), Streptomycin (S) and Ethambutol (E).

Essential 1st line drugs

- **Isoniazid (H),**
- **Rifampicin (R),**
- **Pyrazinadine (Z),**
- **Streptomycin (S) &**
- **Ethambutol (E).**

2. Treatment regimens

Treatment regimens are divided into:

(i) Initial or intensive phase.
(ii) Continuation or maintenance phase.

During the intensive phase, three or four drugs are given daily. This leads to rapid sputum conversion and amelioration of clinical symptoms. During the continuation phase, two or three drugs are usually given intermittently. The sterilising effect of the therapy eliminates remaining bacilli and reduces drastically the chances of subsequent relapse.

Category I: New Case

(i) Intensive phase: 2SHRZ or 2EHRZ or 2HRZ (2 months of daily doses).
(ii) Continuation phase: $4H_2R_2$ or $4S_2H_2R_2$ or 4HR or $4H_3R_3$ or $4S_3H_3R_3$ (Duration may be extended for severe forms of extra pulmonary tuberculosis and immunocompromised patients).

*The number preceding the treatment regimen refers to the treatment duration in months.

**The subscript below the drug symbol refers to the frequency of doses per week.

Category II: Relapse, Treatment failure, Treatment after interruption

(i) Send *Mycobacterium tuberculosis* culture and sensitivity (MTB C&S) (Rapid culture method if available).

(ii) Do not initiate standard therapy.
(iii) Refer to chest physician or physician in charge of chest clinic.
(iv) Subsequent drug regimen based on sensitivity results and clinical response.

Category III: Chronic Case

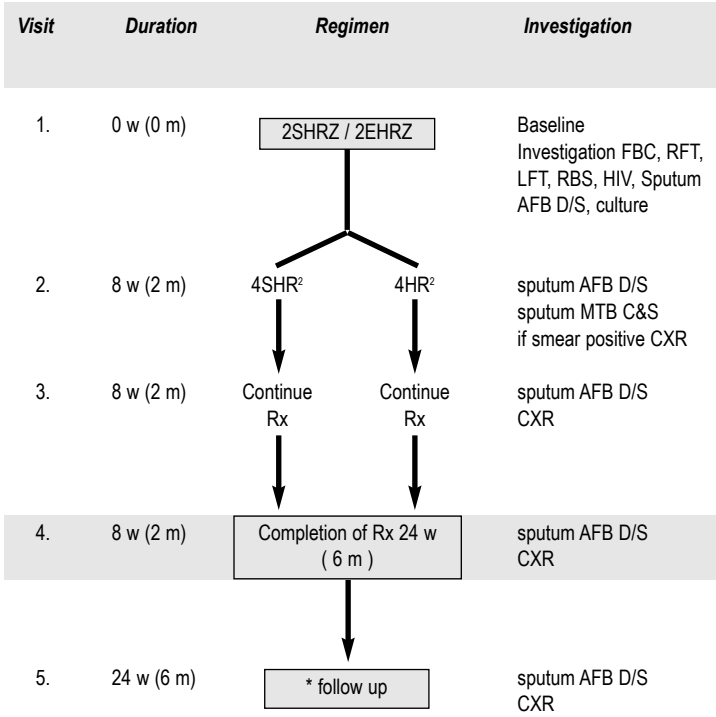
(i) Send *Mycobacterium tuberculosis* culture and sensitivity (MTB C&S) (Rapid culture method if available).
(ii) Refer to chest physician or physician in charge of chest clinic.

3. Anti-tuberculosis drugs (1st line) and the recommended dosages

1st line drug	Daily dosage		Biweekly dosage	
	mg/kg	max (mg)	mg/kg	max (mg)
Isoniazid (H)	5 - 8	300	15 - 20	1200
Rifampicin (R)	10 - 15	600	15 - 20	600
Pyrazinamide (Z)	20 - 40	1500	50	2000
Ethambutol (E)	15 - 25	1200	50	2000
Streptomycin (S)	15 - 20	1000	15 - 20	1000

Note: For patients more than 65 years of age, the dose of streptomycin should not exceed 750 mg.

4. Flow chart for recommended 24 weeks (w) / 6 months (m) treatment regimen (adult)



E = ***Ethambuthol***	***FBC*** = ***Full blood count***	***RBS*** = ***random blood sugar***
H = ***Isoniazid***	***LFT*** = ***Liver function test***	***HIV*** = ***anti-HIV antibody (for screening)***
R = ***Rifampicin***	***RFT*** = ***Renal function test***	***MTB*** = ***Mycobacterium tuberculosis***
S = ***Streptomycin***	***D/S*** = ***Direct smear***	***C&S*** = ***culture and sensitivity test***
Z = ***Pyrazinamide***	***Rx*** = ***Treatment***	
W = ***week***		
M = ***month***		

Note: (*) Recommended to be done where facilities are available

5. Management of Tuberculosis in Special Situations

A. Tuberculosis during pregnancy and lactation

Untreated tuberculosis presents a much greater risk to a pregnant woman and her foetus than does the treatment of the disease. Standard treatment using Isoniazid, Rifampicin, Pyrazinamide and Ethambutol is used. Doses of anti-tuberculosis drugs given in pregnancy are similar to that in a non-pregnant patient. Streptomycin is best avoided because of the risk of ototoxicity to the foetus. Normal recommended dosages of Rifampicin are safe in pregnant patients.

Tuberculosis treatment in lactating mothers is safe as the amount of drug ingested by nursing infant is minimal. If the mother at the time of delivery is smear-positive, the newborn should be separated from the mother at least for a period of two weeks.

Breast-feeding is best avoided during these two weeks and expressed milk should be given to the child. BCG should be given as scheduled and Isoniazid prophylaxis should be given for 6 months followed by Mantoux test at the end of 6 months. In the event of absence of scar, BCG vaccination should be repeated. When there is doubt about the presence of active tuberculosis, the child should be treated.

Congenital tuberculosis, although rare should be suspected if an infant born to a tuberculous mother fails to thrive, has non-specific symptoms such as fever, respiratory distress, poor feeding and vomiting, or has suggestive signs such as hepatosplenomegaly.

B. Tuberculosis treatment for women taking the oral contraceptive pill

Rifampicin interacts with the oral contraceptive pill, with a risk of decreased protective efficacy against pregnancy. A woman who usually takes the oral contraceptive pill may choose between an oral contraceptive pill containing a higher dose of oestrogen (50mcg) or use another form of contraception after consultation with a doctor.

C. Tuberculosis in patients with liver impairment

Patients with no evidence of chronic liver disease (e.g. hepatitis virus carrier, past history of acute hepatitis and alcoholics) can receive the usual short-course chemotherapy regimens but therapy should be modified in patients with established chronic liver disease and acute hepatitis. These cases are best referred to specialists for management.

i) Established chronic liver disease

The following regimens are recommended:

(i) $2SHRE/7H_2R_2$
(ii) 2SHE/10HE
(iii) $2SH/12S_2H_2$

ii) Acute hepatitis (e.g. acute viral hepatitis)

It is a rare eventuality that a patient has tuberculosis and also at the same time acute hepatitis unrelated to tuberculosis or anti-tuberculosis treatment. Clinical judgement is necessary. In some cases it is possible to defer tuberculosis treatment until the acute hepatitis has resolved. In other cases when it is necessary to treat tuberculosis during acute hepatitis, the safest regimen is 3SE/6HR.

D. Tuberculosis in patients with renal impairment

Isoniazid, Rifampicin and Pyrazinamide are either eliminated almost entirely by biliary excretion or metabolised into non-toxic compounds. These drugs can, therefore, be given in normal dosage to patients with renal failure. Streptomycin and Ethambutol are excreted by kidney. Where facilities are available to monitor renal function closely it may be possible to give Streptomycin and Ethambutol in reduced doses. The safest regimen to be administered in patients with renal failure is 2HRZ/6HR.

E. Extra pulmonary tuberculosis

The regimen of treatment is similar as for pulmonary tuberculosis but the duration may be extended and it varies from 6 months to 12 months or longer depending on the clinical response of the individual patient, for example in tuberculosis meningitis, it is advisable to treat the patient for at least 12 months.

Steroids should be given in tuberculous meningitis, genitourinary tract tuberculosis and may also be considered in miliary tuberculosis.

F. Tuberculosis in patients with HIV infection

Recommended treatment regimens for patients who have tuberculosis with HIV infections (The recommendations are based on those of the CDC, Davidson and The American Thoracic Society-modified)

Clinical presentation of TB in HIV/AIDS (from chemotherapy guideline 1994)

Clinical situation	Treatment
Initial therapy ◆ No suspicion of drug resistance	Isoniazid, Rifampicin, Pyrazinamide daily
◆ Possible drug resistance	Isoniazid, Rifampicin, Pyrazinamide, Etambutol daily
Long-term therapy ◆ Drug-susceptible organisms	Isoniazid, Rifampicin, Pyrazinamide for 2 months daily followed by Isoniazid, Rifampicin for 7 months biweekly or for 6 months after cultures are negative, whichever is longer. Avoid protease inhibitor if regimen contains Rifampicin.
◆ Isoniazid resistance or intolerance	Rifampicin, Ethambutol and Pyrazinamide daily for 2 months followed by Rifampicin and Ethambutol daily for 12-16 months or 12 months after cultures are negative, whichever is longer.
◆ Rifampicin resistance or intolerance	Isoniazid, Pyrazinamide, Ethambutol daily for 18months to 24 months, or for 12 months after cultures are negative whichever is longer.

URINARY TRACT INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute Uncomplicated Cystitis *E. Coli* *Enterobacteriaceae:* *Klebsiella* *Proteus* *Enterobacter species* *Staphylococcus - saprophyticus* *Enterococcus*	Trimethoprim 300mg PO q24h for 7 days	Cefuroxime 250mg PO q12h for 7 days **OR** Nitrofurantoin 50mg PO q6h for 7 days **OR** *Trimethoprim/Sulphamethoxazole 160/800mg PO q12h for 3 days	*Avoid sulfonamides in pregnancy
Acute Cystitis in Pregnancy	Cefuroxime 250mg PO q12h for 7 days	Nitrofurantoin 50mg PO q6h for 7 days **OR** Cephalexin 500mg PO q12h for 7 days **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 7 days	Modify treatment based on culture
Recurrent Urinary Tract Infections: > 3 episodes/year	Trimethoprim/Sulphamethoxazole 80/400mg PO ON for 3-12 months	Nitrofurantoin 50mg PO ON for 3-12 months **OR** Cephalexin 250mg PO ON for 3-12 months **OR** Trimethoprim 100mg PO ON for 3-12 months	As Prophylaxis

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute Uncomplicated Pyelonephritis *E. Coli* *Enterobacter* *Proteus* *Pseudomonas*	**If ill, hospitalised** Cefuroxime 750mg IV q8h for 2 weeks **PLUS/MINUS** Gentamicin[1] 5mg/kg IV q24h for 2 weeks *(If use of aminoglycosides deemed undesirable, consider 3rd generation Cephalosporins)*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h for 2 weeks **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h for 2 weeks **OR** Ciprofloxacin 500-750mg PO q12h	Adjust according to culture & sensitivity May step down to oral antibiotic following clinical improvement (afebrile for 48 hours)
Acute Complicated Pyelonephritis Calculi especially struvite stones Urethral stricture or tumour Papillary necrosis Congenital abnormalities Neuropathic bladder Previous genito-urinary surgery predisposing to obstruction Polycystic kidneys *E. Coli* *Proteus sp.* *Klebsiella* *Pseudomonas* *Serratia* *Enterococci*	**If ill, hospitalised** Cefuroxime 750mg IV q8h **PLUS** Gentamicin[1] 5mg/kg IV q24h for 2 weeks **If Enterococci** Ampicillin 500mg IV q6h **PLUS** Gentamicin[1] 5mg/kg IV q24h for 2 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h for 2 weeks **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h **OR** Piperacillin/Tazobactam 4.5g IV q8h for 2 weeks **OR** Ciprofloxacin 200mg IV q12h for 2 weeks	Adjust according to culture sensitivity

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Acute Pyelonephritis in Pregnancy	Cefuroxime 750mg IV q8h for 2 weeks	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 1.2g IV q8h for 2 weeks **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 1-2g IV q24h for 2 weeks	
Asymptomatic Bacteriuria *E. Coli* in 75% of elderly patients *Proteus* *Klebsiella* *Enterobacter* *Pseudomonas*	Trimethoprim 300mg PO q24h for 7 days	Cefuroxime 250mg PO q12h for 7 days **OR** Nitrofurantoin 50mg PO q6h for 7 days **OR** *Trimethoprim/Sulphamethoxazole 160/800mg PO q12h for 3 days	Recommendation for treatment is only for the following conditions:- a) Pregnant women if test results are positive b) Patients who undergo traumatic urologic interventions with mucosal bleeding, and such patients should be treated prior to such interventions c) Before transurethral resection of the prostate *Avoid sulfonamides in pregnancy

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Asymptomatic Bacteriuria in Pregnancy	Cefuroxime 250mg PO q12h for 7 days	Nitrofurantoin 50mg PO q6h for 7 days **OR** *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate 625mg PO q12h for 7 days	Avoid Quinolones
Catheter Related Bacteriuria	Antibiotics not recommended for asymptomatic bacteriuria		Remove or change catheter if possible
Acute Prostatitis	Refer to Page 129 (Urology)		
Chronic Prostatitis	Refer to Page 129 (Urology)		

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

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SECTION B: PAEDIATRICS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. Acute Myocarditis			
Commonly caused by viruses	Treatment mainly supportive		*Reference: 1, 2*
2. Acute pericarditis			
Viral (commonest cause)	Treatment mainly supportive		Consider surgical drainage if pericardial empyema detected
Bacterial: *Staphylococcus aureus*	Cloxacillin 200mg/kg/24h IV in 4-6 divided doses for 6 weeks **PLUS/MINUS** Gentamicin[1] 1mg/kg IV/IM q8h for 3 - 5 days	**Penicillin allergic:** Cefazolin 100mg/kg/24h IV in 3 equally divided doses **OR** Vancomycin[1] 40mg/kg/24h IV in 2-4 divided doses	*Reference: 3, 4*
3. Infective Endocarditis			
Empirical Therapy for Infective Endocarditis	Benzylpenicillin 200,000 units/kg/24h IV in 4-6 equally divided doses for 4 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks	Vancomycin[1] 15mg/kg q12h IV for 4-6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks	*Reference: 3, 4*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Infective Endocarditis caused by Streptococcus Viridans	Benzylpenicillin 200,000 units/kg/24h IV in 4-6 equally divided doses for 4 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 100mg/kg IV/IM q24h for 4 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks For patients allergic to Pencillin or Ceftriaxone: Vancomycin[1] 40mg/kg/24h IV in 2-3 equally divided doses for 4 weeks	Dosages suggested are for patients with normal renal and hepatic function. Maximum dosages per 24 hours: Penicillin 18 million units; Ampicillin 12g; Ceftriaxone 4g, Gentamicin 240 mg. *Reference: 8, 9*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Infective Endocarditis caused by Enterococcus	Benzylpenicillin 300,000 units/kg/24h IV in 4-6 equally divided doses **OR** Ampicillin 300mg/kg/24h IV in 4-6 divided doses for 4-6weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 4-6 weeks	Penicillin allergic: Vancomycin[1] 40mg/kg/day IV in 2-3 equally divided doses **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 2 weeks for 6 weeks	*Reference: 8, 9*
Infective Endocarditis Caused by Staphylococcus a) Methicillin sensitive	Cloxacillin 200mg/kg/24h IV in 4-6 divided doses for 6 weeks **PLUS/MINUS** Gentamicin[1] 1mg/kg IV/IM q8h for 3-5 days		Clinical benefit of aminoglycosides has not been established.
b) Penicillin allergic	Cefazolin 100mg/kg/24h IV in 3 equally divided doses for 6 weeks	Vancomycin[1] 40mg/kg/24h IV in 2-4 divided doses for 6 weeks	Cefazolin or other first-generation cephalosporin in equivalent dosages may be used in patients who do not have a history of immediate type hypersensitivity (urticaria, angioedema, anaphylaxis) to penicillin or ampicillin.

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
c) Methicillin Resistant	Vancomycin[1] 40mg/kg/24h IV in 2-4 divided doses for 6 weeks		Reference: 4, 8, 9
Culture-Negative Endocarditis	*β-lactam/β-lactamase inhibitors,e.g.* Ampicillin/Sulbactam 300mg/kg/24h IV in 4-6 equally divided doses for 4-6 weeks **PLUS** Gentamicin[1] 1mg/kg IV/IM q8h for 4-6 weeks		Patients with culture-negative endocarditis should be treated in consultation with an ID specialist Reference: 4, 8, 9

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

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Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Meningitis empirical treatment	Benzylpenicillin 50mg/kg IV q4-6h **PLUS** *3rd gen. Cephalosporins, e.g.* *Cefotaxime **OR** *Ceftriaxone IV for 10-14 days	Vancomycin[1] 15mg/kg IV q6h **PLUS** *3rd gen. Cephalosporins, e.g.* *Cefotaxime **OR** *Ceftriaxone for 10-14 days	*Reference: 1, 2, 5*
H. influenza	*3rd gen. Cephalosporins, e.g.;* *Cefotaxime **OR** *Ceftriaxone IV for 10-14 days	Chloramphenicol 40mg/kg IV stat then 25mg/kg q6h for 10-14 days;	Prophylaxis for all household contacts if there are unimmunised or partially immunised children < 4 years old (Red Book 2006)
Strep Pneumoniae**	**if MIC < 0.1 mg/L:** Benzylpenicillin 50mg/kg IV q4-6h for 10-14 days **if MIC 0.1- to < 2mg/L** *3rd gen. Cephalosporins, e.g.* *Cefotaxime **OR** *Ceftriaxone for 10-14 days **If MIC > 2mg/L** Vancomycin[1] **PLUS** *3rd gen. Cephalosporins* for 10-14 days	**OR** Cefepime 50mg/kg IV q8h for 10-14 days	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Neisseria meningitidis**	Benzylpenicillin 50mg/kg IV q4-6h for 7 days	*3rd gen. Cephalosporins, e.g.* *Cefotaxime **OR** *Ceftriaxone IV for 7 days; **OR** Chloramphenicol 40mg/kg stat then 25mg/kg IVq6h	Prophylaxis for all household contacts and Health care workers involved in intubation and suctioning of airway
Herpes Simplex encephalitis	Acyclovir: 12 weeks-12 years old: 500mg/m^2 q8h If > 12 years olds: 10mg/kg IV q8h Duration: for 14-21 days		*Reference: 3, 4*
Brain Abscess	*3rd gen. Cephalosporins, e.g.* *Cefotaxime **OR** *Ceftriaxone **PLUS** Metronidazole 15mg/kg IV stat then 7.5mg/kg IV q8h (duration of antibiotic would depends on response by neuroimaging; 4-8 weeks may be needed)	Add Cloxacillin if secondary to trauma	Surgical drainage may be indicated if appropriate *Reference: 4*

*Cefotaxime 50mg/kg q4-6h (severe infection)
*Ceftriaxone 50mg/kg q12h (severe infection)
** Duration of antibiotic may need to be extended as a result of complications subdural empyema or brain abscess

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CHEMOPROPHYLAXIS

A. NON-SURGICAL

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
Rheumatic fever (Secondary prevention)	Benzathine Penicillin IM 1.2 mega units (>25kg); 0.6 mega units (<25 kg) every 3-4 weeks **Duration** *With carditis:* 10 years or until 25 years of age *Without carditis:* 5 years or until 18 years of age **OR** Cephalexin 50mg/kg PO 1 hour prior to procedure	Gentamicin[1] 1.5mg/kg IV within Phenoxymethylpenicillin 250mg PO q12h Penicillin allergy EES 400mg PO q12h	*Reference: 1*
Infective Endocarditis	**Dental, oral, respiratory or esophageal procedures:** Amoxycillin 50mg/kg PO 1 hour before procedure	Penicillin allergy Clindamycin 20mg/kg PO 1 hour before procedure **OR** Azithromycin/Clarithromycin: >10 years old = 500mg >5 and <10 yrs = 300mg <5 yrs = 200mg **OR** 15mg/kg 1 hour before procedure **OR** Cephalexin 50mg/kg PO 1 hour prior to procedure	Prophylaxis recommended for high risk and moderate risk categories and for specific procedures (as described in AHA Recommendations reference 2, 3, 4) *Reference: 2*

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
	Genitourinary or gastrointestinal procedures: *High risk:* Ampicillin 50mg/kg IV **PLUS** Gentamicin[1] 1.5mg/kg IV within 30 minutes prior to procedure **Followed by:** (Repeat Ampicillin 25mg/kg PO 6 hours later) Moderate risk: Amoxycillin 50mg/kg PO 1 hour before procedure		
Post-splenectomy *At risk for pneumococcus, meningococcus, Haemophilus*	Phenoxymethypenicillin: < 5 yrs: 125mg PO q12h > 5yrs: 250mg PO q12h Duration: ◆ Children up to the age of 16 years ◆ Post-splenectomy for at least 2-3 years ◆ Indefinitely for patients with an underlying immunocompromised state and asplenia *(Require ongoing surveillance for resistant pneumococci)*	Amoxycillin 20mg/kg/24h PO Penicillin allergy: EES < 2 yrs: 200mg PO q24h > 2 yrs: 400mg PO q24h	Risk of sepsis is lifelong, but especially the first 2 years after splenectomy Important adjunct: Immunisation against *pneumococcus, haemophilus, meningococcus prior to splenectomy* To seek immediate medical attention when febrile *Reference: 5, 6, 16*

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
H. influenza B exposure	Rifampicin PO Children: 20mg/kg q24h x 4 days Infants: 10mg/kg q24h x4 days		Household contacts If there is one unvaccinated contact ≤4 years old in the household, RIF recommended for all household contacts except pregnant women Nursery Contact ◆ With 1 case, if attended by unvaccinated children ≤2 yrs, consider prophylaxis + vaccinate susceptibles ◆ If all contacts > 2 yrs: no prophylaxis ◆ If ≥2 cases in 60 days and unvaccinated children attend, prophylaxis recommended for children and personnel ◆ Give chemoprophylaxis to index case if treated with regimens other than cefotaxime or ceftriaxone ◆ Contacts < 2 years not immunised: complete immunisation *Reference: 7*

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
Meningococcal exposure	Rifampicin PO Children: <1 month: 5mg/kg q12h for 2 days >1 month: 10mg/kg (max 600mg) q12h for 2 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone IM <15 yrs: 125mg stat >15 yrs: 250mg stat Ciprofloxacin PO >18 yrs 500mg single dose	CLOSE contact: All household, child care and nursery contacts. Others ◆ Close contact for at least 4 hours during the week before illness onset ◆ Exposure to index's nasopharyngeal secretions (eg kissing, sharing of toothbrushes, eating utensils) ◆ Airline flights lasting >8 hours: directly next to case Healthcare staff Routine prophylaxis not recommended, unless exposure to secretions such as unprotected mouth to mouth resuscitation, intubation or suctioning *Reference: 8*
UTI prophylaxis	Refer to Page 202 (Urinary Tract Infections)		

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
Neonatal Group B Strep (GBS) Infection *Treat during labour if previously delivered infant with invasive GBS, GBS bacteriuria or screening swabs positive OR if* ◆ *Preterm <37 weeks* ◆ *PROM >18 hours* ◆ *Intrapartum temp >38ºC*	Intrapartum maternal prophylaxis till delivery Benzylpenicillin 5 mega units IV load then 2.5 mega units q6h	Ampicillin 2g IV load then 1g q6h Penicillin allergy: Erythromycin 500mg IV q6h (according to susceptibility)	*Reference: 12*
Malaria prophylaxis	Mefloquine 5mg/kg PO once a week To start one week before and continued till 4 weeks after leaving the area	Doxycycline 2mg/kg PO q24h (max 100mg/day) in children >8 years old **OR** Clindamycin 10mg/kg q12h in children < 8 years and in pregnancy To start one week before and continued till 4 weeks after leaving the area	*Reference: 13*
Pertussis (Post-exposure prophylaxis)	EES 20mg/kg PO q12h (max.400mg/day) for 10-14 days		Prophylaxis for all household and close contacts irrespective of age and immunization status Complete immunization for close contact ≤ 7 years of age *Reference: 14*

Condition/Infection & Likely Organism	Prophylactic Regimen		Comments
	Preferred	Alternative	
Chicken pox *(Post-exposure prophylaxis)*	*Varicella-Zoster Immune Globulin (VZIG) (125 units/10kg, max 625 units) **OR** Intravenous Immunoglobulin (IVIG) (400mg/kg) within 96 hours *Post-exposure* varicella vaccine may have some benefit		Susceptible hosts include: ◆ Neonate where maternal varicella develops 5 days before and 2 days after delivery ◆ Immunocompromised hosts ◆ Hospitalized premature infants: - <28 weeks regardless of maternal history of varicella - >28 weeks: whose mothers lack reliable history of varicella *Requires DG approval *Reference: 13, 15, 16*
Tuberculosis	<5yrs Isoniazid 5mg/kg/24h for 6 months		Newborns: BCG after 6 months of prophylaxis Follow-up every 2 months If child confirmed positive, treat Prophylaxis > 5 years not recommended If child HIV positive, suggest prophylaxis irrespective of age *Reference: 17*

[1]Refer Appendix 1(Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

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GASTROINTESTINAL INFECTIONS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute Gastroenteritis *Usually viruses eg rotavirus*	Antibiotics not recommended		Oral rehydration is the cornerstone of treatment Antibiotic therapy may prolong carriage state of salmonellosis *Reference: 1*
Dysentery *Shigella, E. coli, Campylobacter*	Most mild infections resolved spontaneously without antibiotics Trimethoprim/Sulphamethoxazole (TMP: 5-8mg/kg/24h) PO in 2 divided doses for 5-7 days **OR** Ampicillin 100mg/kg/24h PO in 4 divided doses for 5-7 days	If severe: *3rd gen. Cephalosporins, e.g.* Cefotaxime 150-200mg/kg/24h IV in 4 divided doses for 7 days	*Reference: 2*
Dysentery *Amoebiasis*	Metronidazole 30-50mg/kg/24h PO in 3 divided doses for 5 days (10 days for severe infection)		*Reference: 2*
Giardiasis	Metronidazole 15mg/kg/24h PO in 3 divided doses for 5 days		*Reference: 2*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Typhoid fever *Salmonella typhi* *S. paratyphi*	Chloramphenicol 50-100mg/kg/24h PO in 4 divided doses for minimum 14 days	In severe infection or suspected resistant organism: *3rd gen. Cephalosporins, e.g.* Ceftriaxone 60-80mg/kg IV q24h for 7-14 days **OR** *Ciprofloxacin PO/IV **OR** Pefloxacin 20-30mg/kg/24h IV in 2 divided doses for 7-14 days	The majority of S. typhi strains in Malaysia are still sensitive to chloramphenicol or ampicillin *Quinolones need to be used with caution in children due to possible arthropathy and rapid development of resistance. However, there is now increasing data on safety and efficacy of quinolones in children
Chronic carrier state (> 1 year)	Ampicillin/Amoxycillin 100mg/kg/24h PO in 3-4 divided doses for 6 weeks **OR** Trimethoprim/Sulphamethoxazole 8/40 mg/kg/24h PO in 2 divided doses for 6 weeks	*Ciprofloxacin 20-30mg/kg/24h PO in 2 divided doses for 4 weeks	*Reference: 8, 9, 10*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Cholera	Trimethoprim/Sulphamethoxazole 8-10mg (TMP)/kg/24h PO in 2 divided doses for 3 days **OR** Tetracycline 50mg/kg/24h PO q6h for 3 days (children > 8 years) **OR** Doxycycline 6mg/kg (max. 300mg) PO q24h (children > 8 years)	Erythromycin 50mg/kg/24h PO in 4 divided doses for 3 days (for strains resistant to tetracyclines) *Single dose Azithromycin or Ciprofloxacin may be considered in special circumstances (e.g. during major outbreaks)*	Oral rehydration is the cornerstone of treatment. Antibiotics therapy reduces the volume and duration of diarrhoea Avoid using Tetracycline or Doxycycline for young children as they can cause staining of the teeth *Reference: 3, 4, 5, 6, 7*
Liver abscess (amoebic) *Entamoeba histolytica*	Metronidazole 35-50mg/kg/24h IV in 3 divided doses for 10-14 days		Amoebic abscess tend to be solitary lesion. Consider surgical drainage if needed *Reference: 11, 12*
Liver abscess (pyogenic) *Gram-ve, Anaerobic, S. aureus*	Ampicillin 150-200mg/kg/24h IV in 4 divided doses **PLUS** Gentamicin[1] 5mg/kg IV q24h PLUS Metronidazole 10mg/kg IV q8h	*3rd gen. Cephalosporins, e.g.* Cefotaxime 50mg/kg IV q6h **PLUS** Metronidazole 35-50mg/kg/24h IV in 3 divided doses	Surgical drainage is needed in most cases *Reference: 11, 12*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	If S. aureus: Cloxacillin 150-200mg/kg/24h IV in 4-6 divided doses **PLUS** Gentamicin[1] 5mg/kg IV q24h for 4-6 weeks		
Acute cholangitis Gram negative, anaerobes, gram positive	Ampicillin 150-200mg/kg/24h IV in 4 divided doses **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Metronidazole 10mg/kg IV q8h for 7 days	*3rd gen. Cephalosporins, e.g.* Cefoperazone 50mg/kg IV q8h **PLUS** Metronidazole 10mg/kg IV q8h	*Reference: 11, 12*
Peritonitis (Primary) Strep. Pneumoniae, gram-neg organisms	Ampicillin 150-200mg/kg/24h IV in 4 divided doses **PLUS** Gentamicin[1] 5mg/kg IV q24h for 7 days	*3rd gen. Cephalosporins, e.g.* Cefotaxime 150-200mg/kg/24h IV in 4 divided doses	*Reference: 11, 12*

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

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INFECTIONS IN IMMUNUCOMPROMISED PATIENTS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
First Line Febrile neutropenia Fever >38°C Neutrophil<500mm³ *Klebsiella sp,* *E.coli, Pseudomonas*	Cefepime 100-150mg/kg/24h IV in 3 divided doses	Piperacillin/Tazobactam 300-360mg/kg/24h IV in 3-4 divided doses	Meta analysis has shown that there is no clinical advantage with β lactam-aminoglycoside combination therapy[1]
Second line Persistent fever > 72 hours *MRSA* *coagulase -ve staph*	Imipenem 20mg/kg IV q8h **PLUS/MINUS** Vancomycin[1] 15mg/kg IV q6h	Meropenem 20mg/kg IV q8h **PLUS/MINUS** Vancomycin[1] 15mg/kg IV q6h	Consider adding Vancomycin in suspected catheter related infections, positive blood culture for gram +ve cocci, hypotension patients and patients who are known to be colonised with MRSA
Third Line Fever > 5 days *Candida sp* *Aspergillus sp*	Imipenem 20mg/kg IV q8h **PLUS** Amphotericin B 0.5mg/kg IV and gradually escalate by 0.25 to 1mg/kg q24h	Meropenem 20mg/kg IV q8h **PLUS** Amphotericin B 0.5mg/kg IV and gradually escalate by 0.25 to 1mg/kg q24h	1/3 of febrile neutropenia patients with persistent fever >1 week have systemic fungal infections[2]

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

References :

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2. 2002 Guidelines for the use of antimicrobial agents in neutropenic patients with cancer. CID 2002; 34:730

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Congenital Infections			
Congenital Syphilis *T pallidum*	Benzylpenicillin 50,000 units/kg IV q12h for the first 7 days of life and q8h thereafter for 10-14 days	Procaine Benzylpenicillin 50,000 units/kg IM q24h in a single dose for 10-14 days	◆ Isolate till non-infectious (at least 24 hours of treatment) ◆ Screen for other STDs and HIV ◆ Investigate and treat parents *Follow-up* Nontreponemal serologic tests at 3, 6, 12 and 24 months. (Should become -ve by 6 months) For those with abnormal CSF - recommended to repeat CSF FEME and VDRL at 6 months intervals. Persistent +VDRL of CSF requires reevaluation and possible re-treatment *Reference: 1, 2*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Congenital Toxoplasmosis *T. gondii*	*Pyrimethamine Initial loading dose of 2mg/kg PO q24h for 2 days followed by 1mg/kg PO q24h *(maximum 25mg)* for 6 months, then 3x/wk for subsequent 6 months **PLUS** Sulfadiazine 50mg/kg PO q12h (maximum 4g) for 1 year **PLUS** Folinic Acid 10mg PO 3 times/wk for 1 year *(I/V formulation of Folinic Acid may be considered for oral use)*	*Pyrimethamine 1.25mg/kg PO every 15 days for 24 months **PLUS** Folinic acid 5mg/week PO	Drug regimen not definitively established. Clinical trials ongoing Prednisone (1mg/kg/day) can be used when active chorioretinitis involves the macula or otherwise threatens vision *Fansidar (Sulfadoxine/ Pyrimethamine) contains 25mg Pyrimethamine *Reference: 4, 5, 6*
Herpes Simplex	Acyclovir 20mg/kg IV q8h Duration: Skin, eyes, mouth: 14 days CNS/Disseminated: 21 days		◆ Isolate ◆ Ocular involvement requires topical antiviral ◆ Screen for other STDs ◆ For CNS disease repeat LP at end of therapy for HSV PCR and treat till negative ◆ Investigate and treat parents *Reference: 7, 8*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Tetanus neonatorum	Metronidazole 5-30mg/kg/24h PO in 2-3 divided doses for 7 days, not to exceed 2g/24h Weight-based dosing: Body weight <2000g 0-7 days: 7.5mg PO/IV q24h 8-28 days: 7.5mg PO/IV q12h Body weight >2000g 0-7 days: 7.5mg PO/IV q12h 8-28 days: 15mg PO/IV q12h Duration: Metronidazole PO/IV for 10 days	Benzylpenicillin 100,000 units/kg IV q12h for 1st wk of life and q6h after 1st wk for 10 days	◆ Debridement ◆ Human Tetanus IG IM; optimum dose for IM human TIG yet to be established ◆ Traditional recommendations: single dose of 3000-6000 units ◆ Limited data suggests doses as low as 500 units as effective Penicillin - GABA antagonist are associated with seizures Metronidazole recommended as choice Check maternal immunisation *Reference: 9, 10*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Gonococcal Ophthalmitis	Immediate and frequent saline eye irrigation Non-disseminated disease: *3rd gen. Cephalosporins, e.g.* Ceftriaxone 25-50mg/kg IV (max 125mg) once Disseminated disease: *3rd gen. Cephalosporins, e.g;* Ceftriaxone 50mg/kg IV q24h 1st week of life, then q12h for 7 days (Cefotaxime for neonates with hyperbilirubinemia)		Prophylaxis for infants born to mothers with gonococcal infections: topical Silver Nitrate 1% ◆ Screen mother and baby for Chlamydial Infection ◆ Screen for other STDs ◆ Investigate and treat parents *Reference: 11,12*
Conjunctivitis *Chlamydia trachomatis*	EES 50mg/kg/24h PO in 4 divided doses for 14 days (Topical therapy not necessary if systemic treatment given)	Azithromycin 20mg/kg PO q24h for 3 days	Diagnosis by tissue culture, antigen detection (IFA, EIA) or NAAT Eye swab from conjunctiva of everted eyelid with Dacron tipped swab or swab from test kit Test also for gonococcus Treat mother & sexual partner Efficacy of treatment 80%, follow-up necessary. Second course of therapy may be required *Reference: 17, 18*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Early onset sepsis (<48 hrs) Sepsis/pneumonia/meningitis) Group B Strep (GB) Gram -ve bacteria (GNB)	Benzylpenicillin IV **OR** Ampicillin IV **PLUS** Gentamicin[1] IV (Till C&S results) <u>Duration:</u> Sepsis: 7-10 days G+ve meningitis: 2 weeks G-ve meningitis: 3 weeks	Ampicillin **PLUS** *3rd gen. Cephalosporins, e.g.* Cefotaxime (Refer Drug Dosages - Frank Shann)	Suspect in maternal chorioamnionitis, sepsis, PROM (>18 hours) Do full septic workup, CXR No evidence from randomised trials to suggest that any antibiotic regimen may be better than any other in the treatment of presumed early neonatal sepsis *Reference: 13*
Group B Strep(GBS) Infection *Streptococcus agalactiae*	Benzylpenicillin IV **OR** Ampicillin IV **PLUS** Gentamicin[1] IV <u>Duration</u> Sepsis: 10 days Meningitis: 14 days Osteomyelitis: 4 weeks		*Reference: 14*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Postnatal Infections			
Community Acquired Infections (Late onset sepsis >48 hrs) Pneumonia, Sepsis Group B Strep *E coli* *Klebsiella* *Enterobacter, S aureus* *Possible Listeria*	Ampicillin **OR** Penicillin **PLUS** Gentamicin[1] *(Refer Drug Dosages - Frank Shann)*	Penicillin **PLUS** *3rd gen. Cephalosporins, e.g.* Cefotaxime *(Refer Drug Dosages - Frank Shann)*	Inadequate evidence from randomised trials in favour of any particular antibiotic regimen for the treatment of suspected late onset neonatal sepsis Discontinue antibiotics after 72 hours if culture negative or course does not support diagnosis *Reference: 15*
Hospital Acquired Infection (Pneumonia, sepsis, meningitis) Based on predominant flora and susceptibility *Coagulase-negative staphylococci, Staphylococcus aureus, E coli, Klebsiella, Pseudomonas, Enterobacter, Candida, GBS, Serratia, Acinetobacter*	Cloxacillin IV **PLUS** Gentamicin[1]/Amikacin[1] IV (Use Cloxacillin if *S.aureus* is a problem in the respective nursery Otherwise replace Cloxacillin with any other antibiotic appropriate for the predominant flora)	*3rd gen. Cephalosporins, e.g.* Cefotaxime IV **PLUS** Gentamicin[1] **OR** Vancomycin[1] IV if MRSA strongly suspected	Antibiotics used should be according to the microorganisms prevalent in NICU

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Necrotising Enterocolitis *Klebsiella, E. Coli, Clostridia, Coagulase-negative Staphylococcus (CoNS), Enterococci, Bacteroides*	Ampicillin IV **PLUS** Gentamicin[1] IV **PLUS** Metronidazole IV For 10-14 days *(Vancomycin[1] if CoNS suspected)*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate **PLUS** Gentamicin[1]	There is insufficient evidence on benefit or risk regarding choice of antibiotic regimens or duration of antibiotic treatment of NEC **Note**: Decisions regarding antibiotic choice and duration might best be guided by culture results & antibiotic resistance patterns present within nurseries *Reference: 15*

[1]Refer to Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)
[2]Refer to Appendix 3 (Antibiotic Dosages For Neonates)

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OCULAR INFECTIONS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Preseptal cellulitis *Strep pneumoniae, Staph aureus, Strepcoccus sp*	Cloxacillin 50mg/kg PO q6h for 5 days	3 months and older and under 40kg, Amoxycillin 25-45mg/kg/24h PO in 3 divided doses	Consider corresponding intravenous antibiotics: ◆ in severe infections ◆ if secondary to sinusitis
Orbital cellulitis/abcess *H. influenzae*	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 20-80mg/kg IV q24h for 7 to 14 days	Less than 20kg: Cloxacillin 25-50mg/kg/24h IV in 4 divided doses Over 20kg: Cloxacillin 250-500mg IV q6h **OR** 0 to 1 week of age *3rd gen. Cephalosporins, e.g.* Cefotaxime 50mg/kg IV q12h 1 to 4 weeks of age *3rd gen. Cephalosporins, e.g.* Cefotaxime 50 mg/kg IV q8h 1 month to 12 years AND under 50kg *3rd gen. Cephalosporins, e.g.* Cefotaxime 50-180mg/kg/24h IV/IM in 2-4 divided doses	Treat underlying cause (e.g. sinusitis) In orbital abscess, surgical drainage is often necessary References: 1. Medical and Surgical Management of Orbital Cellulitis Michael T. Yen, M.D. Contemporary Ophthalmology, June 2005, Vol 4, No.11, Page 1-6 2. Role of Inflammation in Orbital Cellulitis Carolyn E. Kloek, MD Peter A.D. Rubin, MD Manuscript on Role of Inflammation in Orbital Cellulitis Page 57-68

A. UPPER RESPIRATORY TRACT INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Tonsilitis/Pharyngitis	Phenoxymethylpenicillin 10mg/kg PO q6h for 10 days	If allergic to penicillin, EES 20mg/kg PO q12h for 10 days *(max 1gm/day)*	Antibiotic required if: ◆ Streptococcus suspected ◆ fever >38°C ◆ tender cervical lymphadenopaty ◆ tonsillar swelling exudates ◆ **NO** cough *Reference: 1, 11*
Rhinosinusitis	Mainly viral, therefore antibiotic not recommended		*Reference: 1, 5, 11*
Otitis media Sinusitis	Amoxycillin 80-90mg/kg/24h PO in 3 divided doses for 5-7 days	If resistance suspected to Amoxycillin, *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin (90mg/kg/24h)/ Clavulanate PO in 2 divided doses for 5-7 days	*Reference: 6*

B. LOWER RESPIRATORY TRACT INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
1. Community Acquired Pneumonia (Outpatient)			
Less than 5 years *Empirical therapy*	Amoxycillin 30-75mg/kg/24h PO in 3 divided doses for 5-7 days	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin (30-75mg/kg/24h)/ Clavulanate PO in 2 divided doses for 5-7 days **OR** EES 20mg/kg PO q12h	*Reference: 2, 3, 5, 7, 8*
Age more than 5 years	EES 20mg/kg PO q12h for 7 days **OR** Azithromycin 15mg/kg (day 1) PO q24h then 7.5 mg/kg (day 2-5) PO q24h	Amoxycillin 30-75mg/kg/24h PO in 3 divided doses for 5-7 days	
2. Community Acquired Pneumonia (Inpatient)			
Pneumonia inpatient	Benzylpenicillin 30-60mg/kg IV q6h for 7 days	Benzylpenicillin 30-60mg/kg IV q6h **PLUS** Gentamicin[1] 5mg/kg IV q24h for 7 days	Cloxacillin if Staphylococcus aureus *Reference: 3*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
3. Severe Community Acquired Pneumonia			
Severe community acquired	*3rd gen. Cephalosporins, e.g.* Cefotaxime 50mg/kg q4-6h **OR** Ceftriaxone 50mg/kg q12h **OR** Cefuroxime 50mg/kg IV q8h **PLUS** Erythromycin 15-25mg/kg IV q6h for 7 days	Benzylpenicillin 30-60mg/kg IV q6h **PLUS** Gentamicin[1] 5mg/kg IV q24h **PLUS** Erythromycin 15-25mg/kg IV q6h for 7 days	Cloxacillin if Staphylococcus *Reference: 8, 10*

[1]Refer Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

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SKIN AND SOFT TISSUE INFECTIONS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Abscess *Staphyloccus aureus*	Cloxacillin 50-100mg/kg/24h PO/IV in 4 divided doses for 7-10 days		Incision & drainage if indicated. Pus for culture. Parenteral mode for severe infections
Animal bites *Pasteurella multocida, Staphy. Spp, Streptococcus spp*	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin (30-75mg/kg/24h)/ Clavulanate PO in 2 divided doses for 7 days	Amoxycillin (30-75mg/kg/24h)/ Clavulanate PO in 2 divided doses	Consider rabies prophylaxis according to local epidemiology
Cellulitis *Staphyloccus aureus* *Streptococcus pyogenes*	Cloxacillin 50-100mg/kg/24h PO/IV in 4 divided doses for 7-10 days		Parenteral mode for extensive lesions
Impetigo *Staphylococcus aureus,* *Streptococcus pyogenes*	Cloxacillin 50mg/kg/24h PO in 4 divided doses for 7 days	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin (30-75mg/kg/24h)/ Clavulanate PO in 2 divided doses for 7 days **OR** Cephalexin 50-75mg/kg/24h PO in 3 divided doses for 7 days	Localised lesions: Use Mupirocin topical q8h
Necroting fasciitis	Benzylpenicillin 50,000 units/kg IV q4h **PLUS** Gentamicin[1] 5 mg/kg IV q24h		Aggressive surgical debridement; consider combination of Penicillin and Clindamycin and IVIG to bind toxin for streptococcal infection with toxic shock

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Polymicrobial: Gram +ve cocci, Anerobic Gram-ve rods, Anerobes	**PLUS** Metronidazole 10mg/kg IV q8h for 10 days		
Scalded skin syndrome *Staphylococcus aureus*	Cloxacillin 150mg/kg/24h IV in 4 divided doses then, step down to 50mg/kg/24h PO in 4 divided doses for 7 days **OR** Cephalexin 50-75mg/kg/24h PO in 3 divided doses for 7 days		
Scabies Sarcoptes scabeii	For children > 2 years and <12: Benzyl Benzoate emulsion (EBB) 12.5% apply from neck down and leave for 24 hours for 2 days	Gamma Benzene Hexachloride 0.5% (Lindane) apply and leave for 8 hours (not to be repeated in less than a week) **Babies:** Sulphur 6% in calamine lotion q12h **OR** Crotamiton (Eurax) cream q12h for 2-3 weeks **OR** Permethrin 5% cream apply and leave for 8 hours (not for babies less than 2 months)	

[1]Refer to Appendix 1 (Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
A. General Surgery			
Empyema thoracis *Staph aureus*	Cloxacillin 25-50mg/kg/24h IV in 4 divided doses	Based on C&S	
Enterocolitis *Enterobacteriaceae* *enterococci, Bacteroides*	Metronidazole 500mg IV q8h **PLUS** *2nd or 3rd gen Cephalosporins e.g.* Cefuroxime 750mg IV q6-8h or 1.5g IV q6-8h for severe infection **OR** Cefoperazone 100-150mg/kg/24h IV in 2-3 divided doses		
B. Bone & Joints Infections			
Septic Arthritis *Staph. Aureus* *Haemophilus Influenza*	Cloxacillin 200mg/kg/24h IV in 4 divided doses for 14 days followed by oral for 14 days, longer if necessary	*β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin/Clavulanate IV for 14 days followed by oral for 14 days, longer if necessary Depends on C&S	Surgical debridement if necessary

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
MALARIA			
Uncomplicated malaria (Symptomatic infection with malaria parasitaemia without signs of severity or evidence of vital organ dysfunction Plasmodium falciparum	**Artesunate/Mefloquine (Artequine®) *(Refer Notes 1*)* D1-3: Artesunate 4mg/kg PO q24h D1-3: Mefloquine 25mg/kg PO over 2 days **OR** 8.3mg/kg PO q24h *Dosage according to body wt* ***<10kg :*** *Artesunate 25mg q24h for 3 days* *Mefloquine 125mg single dose* ***10-20kg:*** *Artesunate 50mg q24h for 3 days* *Mefloquine 125mg q24h for 3 days* ***20-40kg:*** *Artesunate: 100mg q24h for 3 days* *Mefloquine 250mg q24h for 3 days* *(Artequine® 300/750)* **OR** Artemether/Lumefantrine(Riamet®) *(Refer Notes 2*)*	Quinine D1-7: Quinine10mg salt/kg PO q8h **PLUS** Doxycycline 3.5mg/kg PO q24h **OR** Clindamycin 10mg/kg PO q12h Either drug to be given for 7 days Doxycycline for children >8 years Clindamycin for children <8 years	Check G6PD before giving primaquine Add Primaquine 0.75mg/kg single dose q24h if gametocyte is present at any time during treatment ** Not available in Ministry of Health National Formulary (Artesunate/ Mefloquine available in 3 formulations: Artequine Paediatric in pellets form for small children < 20kg, Artequine 300/750 for those between 20-40kg & Artequine 600/1500 for > 40kg) Notes 1*: - Do not use AS/MQ in pregnancy - AS/MQ may cause seizure in children with epilepsy - AS/MQ interact with Quinine, Chloroquine and Halofantrine and may cause arrthymia

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	<u>*Dosage according to body wt*</u> ***5-14kg:*** *D1: 1 tablet stat then 1 tablet again after 8 hours* *D2-3: 1 tablet q12h* ***15-24kg:*** *D1: 2 tablets stat then 2 tablets again after 8 hours* *D2-3: 2 tablets q12h* ***25-35kg:*** *D1: 3 tablets stat then 3 tablet again after 8 hours* *D2-3: 3 tablets q12h*		GIT symptoms such as abdominal pain, nausea, vomiting and diarrhoea are the most common side effects. Other symptoms include headache, dizziness and insomnia, convulsions and other symptoms <u>Notes 2*:</u> Artemether/Lumefantrine is available as co-formulated tablets containing 20mg of artemether and 120 mg of lumefantrine. Lumefantrine absorption is enhanced by co-administration with fat containing food or milk
Complicated malaria ◆ almost always due to P. falciparum ◆ always suspect mixed infections if vivax / malariae malaria appear more severe than usual *a) Plasmodium falciparum*	D1: **Artesunate 2.4mg/kg IV on admission, then repeat again at 12h	D1:Quinine loading 7mg/kg IV over 1 hour followed by infusion Quinine 10mg/kg over 4 hours then 10mg/kg q8h	Dilute Quinine in 250ml of D5% over 4 hours. **Change to oral if able to tolerate.** Quinine: Maximum 600mg.

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	D2-7: **Artesunate 1.2mg/kg IV q24h	**OR** Loading 20mg/kg IV over 4 hours then IV 10mg/kg IV q8h D2-7: Quinine 10mg/kg IV q8h **PLUS** Doxycycline 3.5mg/kg PO q24h **OR** Clindamycin 10mg/kg/dose q12h Both drugs to be given for 7 days	** Not available in Ministry of Health National Formulary
b) *Plasmodium vivax*	Total Chloroquine 25mg base/kg divided over 3 days as below: D1: 10mg base/kg stat then 5mg base/kg 6 hours later D2: 5mg base/kg q24h D3: 5mg base/kg q24h **PLUS** Primaquine 0.25mg base/kg PO q24h for 14 days	Repeat Chloroquine and Primaquine	Check G6PD status before giving Primaquine Primaquine 0.75mg base/kg once a week for 8 weeks

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
c) Plasmodium knowlesi/malariae	Total Chloroquine 25mg base/kg divided over 3 days, as below: D1: 10mg base/kg PO stat then 5mg base/kg 6 hours later D2: 5mg base/kg PO q24 D3: 5mg base/kg PO q24h	Treat as complicated Plasmodium falciparum	
Mixed infection	Treat as *Plasmodium falciparum*		
LEPTOSPIROSIS			
Leptospirosis *L. ictero-haemorrhagiae,* *L. canicola*	Benzylpenicillin 50,000 units/kg IV q6h for 7 days	*3rd gen. Cephalosporins, e.g.* Ceftriaxone 60-80mg/kg IV q24h **OR** Cefotaxime 150-200mg/kg/24h IV in 4 divided doses for 7 days	*Reference: 2, 3, 4*

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
MELIOIDOSIS			
Melioidosis *Burkholderia Pseudomallei*	Initial therapy: *3rd gen. Cephalosporins, e.g.* Ceftazidime 150mg/kg/24h IV in 3 divided doses for 10-14 days Maintenance: *β-lactam/β-lactamase inhibitors, e.g.* Amoxycillin (60/mg/kg/24h)/ Clavulanate PO in 3 divided doses for total treatment duration of 20 weeks	Initial therapy: Imipenem 75-100mg/kg/24h IV in 3-4 divided doses	Parenteral treatment should be used for at least 10 days or until clear improvement is noted *Reference: 5, 6*
SCRUB TYPHUS			
Scrub typhus *Ricketsia tsutsugamushi*	Chloramphenicol 50-75mg/kg/24h PO in 4 divided doses for 5-7 days	For children > 8 years, Doxycycline 2-4mg/kg/24h in 1-2 divided doses for 5-7 days	Avoid using Tetracycline or Doxycycline for young children as they can cause staining of the teeth *Reference: 7*

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TUBERCULOSIS CHEMOTHERAPY IN CHILDREN

Treatment of TB disease

- Treatments have 2 phases, an initial intensive phase and a second continuation phase.
- Directly observed therapy is recommended for treatment of active disease
- In either phase, treatment can be given daily or three times weekly. Table 1 shows the first line (or essential) anti-TB drugs and their recommended doses

Table 1: Recommended doses of first-line anti-TB drugs for children

Drug	Dose		Intermittent Dose (thrice weekly)	
	Daily Dose (mg/kg/day)	Maximum Dose (mg)	mg/kg/day	Maximum (mg)
Isoniazid (H)	5 (4-6)	300	10 (8-12)	
Rifampicin (R)	10 (8-12)	600	10 (8-12)	600
Pyrazinamide (Z)	25 (20-30)		35 (30-40)	-
Ethambutol (E)	20 (15-25)$_b$		30 (25-35)	
Streptomycin (S)	15 (12-18)		15 (12-18)	

a. Source: *Treatment of tuberculosis: guidelines for national programmes*

b. The recommended daily dose of Ethambutol is higher in children (20 mg/kg) than in adults (15 mg/kg), because the pharmacokinetics are different (peak serum Ethambutol concentration is lower in children than in adults receiving the same mg/kg dose). Although ethambutol was frequently omitted from treatment regimens for children in the past, due in part to concer about the difficulty of monitoring for toxicity (particularly for optic neuritis) in young children, a literature review indicates that it is safe in children at a dose of 20 mg/kg (range 15-25 mg/kg) daily (3)

c. *Streptomycin should be avoided when possible in children because the injection is painful and irreversible auditory nerve damage may occur. The use of Streptomycin in children is mainly reserved for the first 2 months of treatment of TB meningitis*

Table 1: Recommended treatment regimens for children in each TB diagnostic category

TB Diagnostic category	TB cases	Regimena	
		Intensive phase - daily	Continuation phase - daily
III	◆ New smear-negative pulmonary TB (other than in category I) ◆ Less severe forms of extrapulmonary TB	2HRZb	4HR or 6HE
I	◆ New smear-positive pulmonary TB ◆ New smear-negative pulmonary TB with extensive parenchyma involvement ◆ Severe forms of extrapulmonary TB (other than TB meningitis see below) ◆ Severe concomitant HIV disease	2HRZE	4HR or 6HEc
I	◆ TB meningitis	2RHZSd	4HR
II	◆ Previously treated smear-positive pulmonary TB - relapse - treatment after interruption - treatment failure	2HRZES/1HRZE	5HRE
IV	◆ Chronic and MDR-TB	Specially designed standardised or individualised regimens refer ID paediatrician	
E, Ethambutol; H, Isoniazid; R, Rifampicin; S, Streptomycin; Z, Pyrazinamide			

a. Direct observation of drug administration is recommended during the initial phase of treatment and whenever the continuation phase contains Rifampicin
b. In comparison with the treatment regimen for patients in diagnostic category I, Ethambutol may be omitted during the initial phase of treatment for patients with non-cavitary, smear-negative pulmonary TB who are known to be HIV-negative, patients known to be infected with fully drug-susceptible bacilli and young children with primary TB
c. This regimen (2HRZE/6HE) may be associated with a higher rate of treatment failure and relapse compared with the 6-month regimen with Rifampicin in the continuation phase
d. In comparison with the treatment regimen for patients in diagnostic category I, Streptomycin replaces Ethambutol in the treatment of TB meningitis

Corticosteroids

- ◆ May be used for the management of some complicated forms of TB, e.g. TB meningitis, complications of airway obstruction by TB lymph glands, and pericardial TB
- ◆ Recommended in all cases of TB meningitis

Prednisolone

- dosage of 2mg/kg daily
- increased up to 4mg/kg daily in more seriously ill children
- maximum dosage of 60mg/day for 4 weeks
- dose should then be gradually reduced over 1-2 weeks before stopping

Reference: Guidance for national tuberculosis programmes on the management of tuberculosis in children WHO/HTM/TB/2006.371 WHO/FCH/CAH/2006.7

URINARY TRACT INFECTIONS

Condition/Infection & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Acute cystitis *E. Coli* *Proteus spp*	Trimethoprim 4mg/kg PO q12h (max 300mg daily) for 1 week	Trimethoprim(4mg/kg)/ Sulphamethoxazole PO q12h for 1 week	Cephalexin and Cefuroxime can also be used for UTI especially in children who had prior antibiotics Note: single dose of antibiotic therapy not recommended
Acute pyelonephritis Organisms: *E. Coli* *Proteus spp*	*3rd gen. Cephalosporins, e.g.* Cefotaxime 100mg/kg/24h IV in 3 divided doses for 10-14 days	Cefuroxime 100mg/kg/day IV q8h; **OR** Gentamicin[1] 5mg/kg IV q24h	Culture should be repeated within 48hours. Antibiotic may need to be changed according to sensitivity Suggest to continue intravenous antibiotic until child is afebrile for 2-3 days and then switch to appropriate oral therapy after culture results *e.g.* Cefuroxime, for total of 10-14 days if susceptible
Prophylaxis for UTI	Trimethoprim 1-2mg/kg PO ON	Nitrofurantoin 1-2mg/kg PO ON	Antibiotic prophylaxis should not be routinely recommended in children with UTI Prophylactic antibiotics should be given for 3 days with MCUG (Micturating Cystourethogram) taking place on the second day[1]

[1]Refer Appendix 1(Clinical Pharmacokinetic Guidelines: Aminoglycosides & Vancomycin)

1 The Cochrane Database of Systematic Reviews
2. The Cochrane Library, Copyright 2006, The Cochrane Collaboration Volume (4), 2006
3. Stanley Hellerstein, MD. E-medicine, Urinary Tract infection Nov 2006
4. NICE Guidelines: Urinary tract infection: diagnosis, treatment and long term management of urinary tract infection in children 2007

VASCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
IV line temporary/semi-permanent/tunnel type			
S. epidermidis *S. aureus*	Vancomycin[1] 40mg/kg/24h IV in 3 divided doses (CoNS/MRSA) Cloxacillin 100mg/kg/24h IV in 4 divided doses (MSSA)		◆ *S. epid:* can try to save catheter 80% cure rate after 7-10 days of treatment ◆ S. aureus: remove catheter
*Candida sp** *C. albicans*	Fluconazole 10mg/kg IV infusion stat, then 3-6mg/kg IV q24h		*Immunocompromised - Amphotericin B efficacy limited - treat +ve blood cultures - remove catheter *Reference: 3*
Non-C. albicans	Amphotericin B 0.5-1mg/kg IV infusion over 4 hours q24h		Fungal & Staph : Antibiotic therapy is usually given 2 weeks after catheter line removal *Reference: 1*
Septic thrombophlebitis			
S. aureus *MSSA* *MRSA*	Cloxacillin 100mg/kg/24h IV in 4 divided doses (MSSA) Vancomycin[1] 40mg/kg/24h IV in 3 divided doses (MRSA)		Gram-ve: Antibiotic therapy is given for additional 1 week after catheter removal

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APPENDICES

Appendix 1

CLINICAL PHARMACOKINETIC GUIDELINES

AMINOGLYCOSIDES AND VANCOMYCIN

1. AMINOGLYCOSIDES

A. Single Daily Dosing
B. Extended Internal Dosing
C. Conventional Dosing

A. SINGLE DAILY DOSING (SDD)

Definition;
Is an approach of administrating aminoglycosides for otherwise healthy individuals in a single daily dose by slow infusion (30 minutes).

The pharmacodynamic rationale for SDD is based on the following concepts[1]:

- Aminoglycosides display concentration-dependent bactericidal action-that is, higher dose and serum concentrations result in more rapid bacterial killing.
- Aminoglycosides exhibit a long post-antibiotic effect, resulting in persistent bacterial suppression even when serum concentrations decline large, single daily doses result in prolonged periods with negligible serum concentrations, potentially reducing renal cortical and auditory accumulation of the drug.
- SDD has the potential of reducing costs associated with drug administration and monitoring; patient convenience and outpatient administration are also facilitated by SDD.
- Below the MIC and thereby allowing less frequent drug administration.

Exclusion criteria;
SDD administration of aminoglycosides is reasonable in most patients, with the following exceptions2:

- Diagnosed with enterococcal endocarditis, for which multiple(conventional) dosing regimens have been found superior in experimental animals
- Pregnant patients;
- Children;
- Patients with severe renal insufficiency; and
- Patients with neutropenia, unless the aminoglycoside is used in combination with a β-lactam antibiotic agent.

Conventional multiple daily dosing regimens should also be considered for the treatment of serious *P. aeruginosa* infections (other than those confined to the urinary tract) because publish studies have included relatively few of these cases.

TABLE 1: RECOMMENDATIONS FOR SINGLE DAILY DOSING OF AMINOGLYCOSIDES			
Estimated creatinine clearance (mL/min)*	Dose (mg/kg)		Dose interval (h)
	Gentamicin or Tobramycin	Amikacin	
>80	5.0	15.0	24
60-79	5.0	12.0	24
50	3.5	7.5	24
40	2.5	4.0	24
<30	Use conventional dosing		

Monitoring:

- Suspected unstable renal function- Post 2 hours and Post 7 hours
- Suggested monitoring: assess 18-hours serum concentration after second dose.
- Suggested "trough" levels:
  - 0.6 to 2.0 μg/mL for Gentamicin or Tobramycin;
  - 2.5 to 5.0 μg/mL for Amikacin.

Data from Gilbert.[3]

B. EXTENDED INTERVAL DOSING

Definition;

Is an approach of giving standard dosing over 30 minutes at an extended interval (24 hourly, 36 hourly or more). The theoretical benefits of high-dose, extended-interval dosing are to[4]:

- Optimise concentration-dependent bacterial killing by achieving a high peak (>10x MIC).
- Minimize nephrotoxicity by administering larger, less frequent doses and potentially decreasing renal cortical aminoglycoside concentrations.
- Utilize the post-antibiotic effect (PAE), defined as a recovery period before organisms can resume growth after drug removal.
- Minimize the development of adaptive resistance by allowing a recovery period during the dosing interval.

Patient's criteria:

Inclusion criteria[5]	Exclusion criteria
• Concurrently receiving nephrotoxic agents such as amphotericin, cyclosporin or vancomycin • Exposed to contrast media • Quadriplegics or amputees • In the intensive care unit • More than 60 years of age • Continue on the once a day dose fo more or equal than 5 days whose drug random concentration should be determined once a week thereafter	• Elderly (>65 yrs) • Creatinine clearance less than 30ml/min • Dialysis • Pregnancy • Endocarditis • Cystic fibrosis • Ascites • >20% burns • History of hearing loss or vestibular dysfunction • Gram positive infections (when AMG is used for synergy) • Mycobacterial infection

Dose adjusted to Creatinine Clearance[6]

Drug	Dose (mg/kg)	CrCl : >60ml/min	CrCl : 40-59ml/min	CrCl : 20-39 ml/min	CrCl : <20ml/min
Amikacin	15	Q24 hours	Q36 hours	Q48 hours	NR
Gentamicin	5-7	Q24 hours	Q 36 hours	Q48 hours	NR
Netilmicin	5-7	Q24 hours	Q36 hours	Q48 hours	NR
Tobramycin	5-7	Q24 hours	Q 36 hours	Q48 hours	NR

NR-Not recommended

Monitoring:

At the second dose.

1. Trough level (1 hour before the next dose): <1mg/L or less
   - If >1mg/L extension of dosing interval necessary
2. Post levels (7-14 hours post dose): varies with dose and renal function
   - Determining new dosing interval by plotting to normograms eg. Hartford Hospital monogram

C. CONVENTIONAL DOSING

Definition;

Is an approach of administrating in slow bolus dosing (50mg/minute) of Aminoglycosides in 8 hourly dosing.

Inclusion Criteria:

- Patients (especially when immunosuppressed) are receiving for life threatening infections
- Patients expected to require prolonged therapy (whose drug concentrations should be determined within 48 hours of therapy initiation and monitored at least once a week)
- Patients not responding to treatment or have suspected aminoglycoside- related toxicity but continuation of therapy is desirable.

TABLE 2: RECOMMENDED* DOSAGES AND SERUM CONCENTRATIONS OF THE AMINOGLYCOSIDES: CONVENTIONAL MULTIPLE DAILY DOSING

Drug	Route	Daily dosage*		Serum concentration† (μg/mL)	
		Total (mg/kg)	Divided into doses given	Peak‡	Trough
Gentamicin	IV or IM	3-5§	Every 8 h	4-6	1-2
Tobramycin	IV or IM	3-5	Every 8 h	4-6	1-2
Netilmicin	IV or IM	3-5	Every 8 h	4-6	1-2
Amikacin	IV or IM	15	Every 8 h	20-30	5-10

*Recommendations

- based on normal renal function.
- Adjustments of dosage based on age and impaired renal function

- †"Peaks" shown are expected levels.
  - Higher peak serum concentrations are desirable in the treatment of life-threateing disease (for example, endocarditis) or less susceptible organisms.
  - When aminoglycosides are used for synergistic therapy, lower serum levels ar needed.
- ‡Serum specimen obtained
  - After third dose (after 24 hours)
  - Trough - 30 minutes after completion of 30-minute intravenous infusion - Post - 3 to 60 minutes after intramuscular administration.
- §For serious infections,
  - 5mg/kg should be administered. For example, endocarditis caused by *Pseudomonas aeruginosa* in a young patient who has illicitly used drugs intravenously),
- 8mg/kg per day of Gentamicin or Tobramycin has been
  - considerable toxicity affecting cranial nerve VIII has been reported with use of this high dosage.

TABLE 3. GUIDELINES FOR DESIRED SERUM CONCENTRATIONS OF AMINOGLYCOSIDES FOR MULTIPLE DAILY ADMINISTRATION[a]

Clinical situation	Serum concentration (mg/L)	
	Gentamicin, Tobramycin and Netilmicin[3]	Amikacin
Trough:		
serious infection	0.5-1.0	1.0-4.0
life-threatening infection	1.0-2.0	4.0-8.0
Peak:		
serious infection	6.0-8.0	20.0-25.0
life-threatening infection	8.0-10.0	25.0-30.0

[a]Higher peak and trough values have also been suggested.

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AMINOGLYCOSIDES DOSING AND MONITORING GUIDELINES

AMIKACIN, GENTAMICIN, NETILMICIN, TOBRAMYCIN,

Conventional Dosing (Multiple dosing) Patient's characteristics:

- Patients (especially when immunosuppressed) are receiving for life threatening infections
- Patients expected to require prolonged therapy (whose drug concentrations should be determined within 48 hours of therapy initiation and monitored at least once a week)
- Patients not responding to treatment or have suspected aminoglycoside-related toxicity but continuation of therapy is desirable
- Endocarditis, Cystic fibrosis

Dose: Divided into 8 hourly dosing per 24 hours
Gentamicin, Netilmicin, Tobramycin: 3-5mg/kg
Amikacin: 15mg/kg

Monitoring:
Post: 30-60 minutes after dose
Pre: 30 minutes before next dose

Serum concentration:
Peak: 4-6mg/L (Gentamicin, Netilmicin, Tobramycin)
20-30mg/L (Amikacin)

Trough: 1-2mg/L (Gentamicin, Netilmicin, Tobramycin)
5-10mg/L (Amikacin)

Single Daily Dosing (SDD) Patients's characteristics:

SDD administration of aminoglycosides is reasonable in most patients, with the following exceptions:

- Diagnosed with enterococcal endocarditis, for which multiple dosing regimens have been found superior in experimental animals
- Pregnant patients;
- Children;
- Patients with severe renal insufficiency; and
- Patients with neutropenia, unless the aminoglycoside is used in combination with a β-lactam antibiotic agent.

Dose : Single daily (24 hourly) dose by slow infusion (30 minutes)

CrCl >80ml/min: Gentamicin, Tobramycin=5mg/kg
Amikacin = 15mg/kg
CrCl 60-79ml/min: Gentamicin, Tobramycin =4mg/kg
Amikacin = 12mg/kg
CrCl 50-69ml/min: Gentamicin, Tobramycin =3.5mg/kg
Amikacin =7.5mg/kg
CrCl 40-49ml/min:Gentamicin, Tobramycin = 2.5mg/kg
Amikacin = 4mg/kg
CrCl <30ml/min: Use conventional dosing

Monitoring: 18 hours post dose
Serum level: Gentamicin, Tobramycin = 0.6 to 2mg/L,
Amikacin = 2.5 to 5.0mg/L

Extended Interval Dosing Patient's characteristics:

- Concurrently receiving nephrotoxic agents
- Such as amphotericin, cyclosporin or vancomycin
- Exposed to contrast media
- Quadriplegics or amputees
- In the intensive care unit
- > than 60 years of age
- Continue on the once a day dose for more or equal than 5 days whose drug random concentration should be determined once a week thereafter

Dose: Slow infusion over 30 minutes at an extended interval of 24, 36 or 48 hours.

Gentamicin, Netilmicin, Tobramycin: 5-7mg/kg
Amikacin: 15mg/kg
CLCr < 60ml/min-24 hourly
CLCr 40-59ml/min-36 hourly
CLCr 20-39ml/min-48 hourly

Monitoring:
Trough: 1 hour before dose
Peak: 7-14 hours (Dosage adjustment by normogram)

Serum concentration:
Trough: < 1mg/L

2. VANCOMYCIN

A. Therapeutic Drug Monitoring Guidelines For Aminoglycosides
B. Target Therapeutic Levels For Multiple Daily Dosing Aminogycosides

Vancomycin has been administered to treat Gram-positive infections since the 1950s, and because of the dramatic rise in drug resistance gram-positive infections caused by *Staphylococcus, Streptococcus, and Enterococcus* organisms, its use has increased[2].

It is indicated to treat *Methicillin-resistant Staphylococcus aureus*, confirmed by culture and sensitivity result, unless the clinical condition and past history reckon Vancomycin to be started as soon as possible.

Vancomycin activity is considered to be time-dependent - that is, antimicrobial activity depends on the duration that the drug level exceeds the minimum inhibitory concentration (MIC) of the target organism. Thus, peak levels have not been shown to correlate with efficacy or toxicity - indeed concentration monitoring is unnecessary in most cases.

Dosing of Vancomycin is based on 10-20 mg/kg/dose every 6 hours. Some literature recommended on 1g every 12 hours. Due to its pharmacodynamic properties, giving a small dose more frequently is more advantageous, provided that the renal function is normal.[1]

Vancomycin exhibit most common administration-related side effects called 'Red-man syndrome'. This side effect happens in response to histamine release due to rapid infusion. Vancomycin should be administered over 1 to 2 hours' infusion to prevent this adverse effect from happening.

Other common side effects are:
1. Nephrotoxicity
2. Ototoxicity
3. Thrombophlebitis - related to site of administration

A. Therapeutic Drug Monitoring Guidelines For Vancomycin

DRUGS	TIME FOR 1ST SAMPLING	IDEAL SAMPLING TIME	COMMENTS
Vancomycin	AFTER 24 HOURS	POST LEVEL: 1 hour after infusion ends. TROUGH LEVEL: Within 30 minutes before the next dose.	Subsequent level: ONLY TROUGH LEVEL REQUIRED.

B. Target Therapeutic Levels For Vancomycin

DRUGS	THERAPEUTIC RANGE (mg/L)			
	PEAK		TROUGH	
	Mild Infections	Severe Infections	Mild Infections	Severe Infections
Vancomycin	20-40	20-40	10-15	15-20

References:

1. Leader WG, Chandler MHH, Castiglia M. Pharmacokinetic optimization of vancomycin therapy. Clin Pharmacokinetic. 1995; 28(4): 327-42. - Level III
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ANTIBIOTIC DOSAGES IN ADULTS PATIENTS WITH IMPAIRED RENAL FUNCTION

Unless stated, adjusted doses are % of dose for normal renal function

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
ANTIBACTERIAL						
Aminoglycoside: Traditional multiple daily doses - adjustment for renal disease						
Amikacin	7.5mg/kg q12h	60-90% q12h or 100% q12 24h	30-70% q12-18h or 100% q24-48h	20-30% q24-48h or 100% q48-72h	HEMO: Extra 1/2 of normal renal function dose AD CAPD: 15-20mg lost/L dialysate/day	High flux hemodialysis membranes lead to unpredictable aminoglycoside clearance, measure post-dialysis drug levels for efficacy and toxicity. With CAPD, pharmacokinetics highly variable - check serum levels. Usual method for CAPD: 2 liters of dialysis fluid placed qid or 8 liters/day (give 8Lx20 mg lost/L = 160 mg of Amikacin supplement IV per day). Adjust dosing weight for obesity: [ideal body weight + 0.4(actual body weight - ideal body weight)]. Where possible dosage modifications should be based on monitoring of individual pharmacokinetic parameters. Please see TDM section.
Gentamicin, Tobramycin	1.5mg/kg q8h	60-90% q8 12h or 100% q12-24h	30-70% q12h or 100% q24-48h	20-30% q24-48h or 100% q48-72h	HEMO: Extra 1/2 of normal renal function dose AD CAPD: 3-4mg lost/L dialysate/day	
Netilmicin	2mg/kg q8h	50-90% q8 12h or 100% q12-24h	20-60% q12h or 100% q24-48h	10-20% q24-48h or 100% q48-72h	HEMO: Extra 1/2 of normal renal function dose AD CAPD: 3-4mg lost/L dialysate/day	
Streptomycin	15mg/kg (max. of 1g) q24h	q24h	q24-72h	q72-96h	HEMO: Extra 1/2 of normal renal function dose AD CAPD: 20-40mg lost/L dialysate/day	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Carbapenem						
Imipenem	250-1000mg q6h	100%	50%	25%	HEMO: Dose AD CAPD: Dose for CrCl <10	↑ potential for seizures if recommended doses exceeded in patients with CrCl<20 ml/min. Refer package insert for patients <70 kg
Meropenem	500-1000mg q6h	500mg q6h	250-500mg q12h	250-500mg q24h	HEMO: Dose AD CAPD: Dose for CrCl <10	
Cephalosporin: DATA ON SELECTED **PARENTERAL** CEPHALOSPORINS						
Cefazolin	500-1500mg q6h	q8h	q12h	q24-48h	HEMO : 0.5-1.0G AD CAPD: 0.5G q12h	
Cefepime	250-2000mg q8h	q12h	q16-24h	q24-48h	HEMO: 1g AD CAPD: dose for CrCl<10	Children with impaired renal function: Age 2 months months to 12 years; 50mg/kg and age 1 month to 2 months; 30mg/kg equivalent to adult 2g. Same reduction in dose and/or increase in interval as of adult with renal impairment. (Product insert).

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Cefotaxime	2g q8h	q8-12h	q12-24h	q24h	HEMO: Extra 1g AD CAPD: 0.5-1g qd	Active metabolite of cefotaxime in ESRD. ↓ dose further for hepatic & renal failure.
Cefoperazone/ Sulbactam	2g q12h	2g q12h	2g q12h	1g q12h	Only sulbactam component affected by hemodialysis. Dosing scheduled following dialysis period	
Ceftazidime	2g q8h	q8-12h	q24-48h	48h	HEMO: Extra 1g AD CAPD: 0.5g qd	Volume of distribution increases with infection.
Cefuroxime	0.75-1.5g q8h	q8h	q8-12h	q24h	HEMO: Dose AD CAPD: Dose for CrCl <10	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Fluoroquinolone						
Ciprofloxacin	500-750mg PO (or 400mg IV) q12h	100%	50-75%	50%	HEMO: 250mg PO or 200mg IV q12h CAPD:250mg PO or 200mg IV q8h	
Levofloxacin	500mg q24h	100%	250mg q24-48h (500mg initial dose)	250mg q48h (500mg initial dose)	HEMO & CAPD: Dose for CrCl <10	
Ofloxacin	400mg PO/IV q12h	100%	200-400mg q12h	200mg q24h	HEMO: 100-200mg AD CAPD: Dose for CrCl <10	
Macrolide						
Clarithromycin	0.5-1g q12h	100%	75%	50-75%	HEMO: Dose AD CAPD: None	ESRD dosing recommendations based on extrapolation
Erythromycin	250-500mg q6h	100%	100%	50-75%	HEMO/CAPD/CAVH: None	Ototoxicity with high doses in ESRD. Vol. of distribution increases in ESRD.

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Miscellaneous Antibacterials						
Colistin	80-160mg q8h	160mg q12h	160mg q24h	160mg q36h	HEMO: 80mg AD	
Linezolid	600mg PO/IV q12h	600mg q12h	600mg q12h	600mg q12h AD	HEMO: As for CrCl <10 CAPD: No data	Accumulation of 2 metabolites - risk unknown
Metronidazole	7.5mg/kg q6h	100%	100%	50%	HEMO: Dose AD CAPD: Dose for CrCl <10	HEMO clears metronidazole and its metabolites
Nitrofurantoin	50-100mg	100%	Avoid	Avoid	Not applicable	
Sulfamethoxazole	1g q8h	q12h	q18h	q24h	HEMO: Extra 1g AD CAPD: 1g qd	
Trimethoprim	100-200mg q12h	q12h	q18h	q24h	HEMO: Dose AD CAPD: q24h	New hemodialysis membranes ↑ clear. of Vancomycin; check levels. Individualised dosage based on plasma concentration is generally preferred. Other method : Loading dose 15mg/kg followed by dose equiv. to15 times GFR daily. In anuric patients, 1g q 7-10 days.
Vancomycin	1g q12h	1g q12h	1g q24-96h	1g q4-7d	HEMO/CAPD: Dose for CrCl <10	
Polymyxin B	1-1.25mg/kg q12h (1mg=10,000 iu)	0.5-1mg/kg q12h	0.5mg/kg q12h	0.2mg/kg q12h		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Penicillins						
Amoxycillin, Ampicillin	250-500mg q8h 250mg-2g q6h	q8h q6h	q8-12h q6-12h	q24h q12-24h	HEMO: Dose AD CAPD: 250mg q12h	
Amoxycillin/ Clavulanate	500/125mg q8h	500/125mg q8h	250-500mg AM component q12h	250-500mg AM component q24h	HEMO: As for CrCl <10; extra dose after dialysis	
Ampicillin/ Sulbactam	2g AM + 1g SB q6h	q6h	q8-12h	q24h	HEMO: Dose AD CAPD: 2g AM / 1g SB q24h	
Benzylpenicillin	0.5-4 million U q4h	100%	75%	20-50%	HEMO: Dose AD CAPD: Dose for CrCl <10	1.7 mEq potassium/mU.↑ potential for seizures. 6mU/d upper limit dose in ESRD.
Piperacillin	4g q4-6h	q4-6h	q6-8h	q8-12h	HEMO: Dose AD CAPD: Dose for CrCl <10	1.9 mEq sodium/g
Pip(P) / Tazo(T)	4.5g q6h	4.5g q6h	2.25g q6h	2.25g q8h	HEMO: Dose for CrCl <10 + 0.75g AD CAPD: Dose for CrCl <10	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Tetracycline						
Tetracycline	250-500mg q6h	q8-12h	q12-24h	q24h	HEMO/CAPD: None	Avoid in ESRD
ANTIFUNGAL						
Amphotericin B & ampho B lipid complex	Non-lipid: 0.4-1.0 mg/kg/d ABCC: 3-6mg/kg/d ABLC: 5mg/kg/d LAB: 3-5mg/kg/d	q24h	q24h	q24-48h	HEMO: None CAPD: Dose for CrCl <10	For Ampho B, toxicity lessened by saline loading; risk amplified by concomitant nephrotoxic drugs
Fluconazole	200-400mg q24h	200-400mg q24h	100-200mg q24h	100-200mg q24h	HEMO: 100% of recommended dose AD CAPD: Dose for CrCl <10	
Itraconazole PO	100-200mg q12h	100%	100%	100%	HEMO/CAPD: No adjustment with oral solution	
Flucytosine	200mg/kg q6h	**>50 ml/min** q6h	**10-50 ml/min** q12-24h	**<10 ml/min** q 24-48h	HEMO/CAPD: Dose AD	
Voriconazole, IV	6mg/kg IV q12h x 2, then 4mg/kg q12h	No change	If CrCl <50 ml/min, accumulation of IV vehicle (cyclodextrin). Switch to PO or suspension (no dose adjustment).			

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
ANTIPARASITIC						
Pentamidine	4mg/kg/d	q24h	q24h	q24-36h	HEMO/CAPD: None	
ANTIPARASITIC						
Ethambutol	15-25mg/kg q24h	q24h	q24-36h	q48h	HEMO: Dose AD CAPD: Dose for CrCl <10	25mg/kg 4-6 hrs prior to dialysis for usual 3x/wk dialysis. Streptomycin recommended in lieu of Ethambutol in renal failure.
Isoniazid	5mg/kg q24h (max. 300mg)	100%	100%	max. 200mg daily	HEMO: Dose AD CAPD: Dose for CrCl <10	
Pyrazinamide	25mg/kg q24h (max. dose 2.5g q24h)	25mg/kg q24h	25mg/kg q24h	12-25mg/kg q24h	HEMO: 25-35mg/kg after each dialysis CAPD: No reduction; CAVH: No data	
Rifampin	600mg q24h	600mg q24h	300-600mg q24h	300-600mg q24h	HEMO: None CAPD: Dose for CrCl <10	Biologically active metabolite.
Ethionamide	500-750mg q12-24h	100%	100%	50%	No dosage adjustments	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
ANTIVIRAL						
Acyclovir, IV	5-10mg/kg q8h	5-10mg/kg q8h	5-10mg/kg q12-24h	2.5mg/kg q24h	HEMO: Dose AD CAPD: Dose for CrCl <10	Rapid IV infusion can cause renal failure.
Adefovir	10mg PO q24h	10mg q24h	10mg q48-72h	No dosing recommendation	HEMO: 10mg q7d AD	
Ganciclovir	Induction 5mg/kg q12h IV	2.5-5mg/kg q12h	1.25-2.5mg/kg q24h	1.25mg/kg 3x/wk	HEMO: 1.25mg/kg AD CAPD: Dose for CrCl <10	
	Maintenance 5mg/kg q24h IV	2.5-5.0mg/kg q24h	0.625-1.25mg/kg q24h	0.625mg/kg 3x/wk	HEMO: 0.625mg/kg AD CAPD: Dose for CrCl <10	
Indinavir / nelfinavir / nevirapine	No data on influence of renal insufficiency. Less than 20% excreted unchanged in urine. Probably no dose reduction.					
Lamivudine (HIV)	150mg q12h	100%	50-150mg q24h (full first dose)	25-50mg q24h (50mg first dose)	HEMO: Dose AD CAPD: Dose for CrCl <10	
Lamivudine (HepB)	100mg PO q24h	**30-49 ml/min** 100mg 1st dose, then 50mg q24h	**15-29 ml/min** 100mg 1st dose, then 25mg q24h	**5-14 ml/min** 35mg 1st dose, then 15mg q24h	< 5 ml/min: 35mg 1st dose, then 10mg q24h. HEMO/CAPD: No dosage adjustment or additional dose.	
Ritonavir & Saquinavir, SGC	Negligible renal clearance. At present, no patient data. Avoid oral solution due to propylene glycol content.					

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR HAEMODIALYSIS, CAPD	COMMENTS
		> 50-90	10-50	< 10		
Stavudine, PO	40mg q12h	100%	50% q12-24h	≥60kg: 20mg/d <60kg: 15mg/d	HEMO: Dose as for CrCl <10 AD CAPD: No data	
Zidovudine	200mg q8h or 300mg q12h	200mg q8h or 300mg q12h	200mg q8h or 300mg q12h	100mg q8h	HEMO: 100mg q8h AD CAPD: Dose for CrCl <10	

AD = after dialysis. **"Dose AD" refers only to timing of dose with NO extra drug**

D = dosage reduction, **I** = interval extension; **ABCC =** Ampho B Cholesteryl Complex (e.g. Amphocil) ; **ABLC** = Ampho B Lipid Complex (e.g. Abelcet); **LAB =** Liposomal Ampho B (e.g. AmBisome); SGC=Soft gel capsule

ANTIBIOTIC DOSAGES FOR NEONATES

Antibiotics	Routes	Dosages (mg/kg/dose) and Intervals of Administration				
		Weight < 1200g	Weight 1200-2000g		Weight > 2000g	
		Age 0-4 weeks	Age 0-7 days	>7 days	Age 0-7 days	>7 days
Acyclovir	IV	20 q8h or 500mg/m^2/dose q8h				
Amikacin	IV, IM	7.5 q18 - 24h	7.5 q12h	7.5-10 q8-12h	7.5-10 q12h	10 q8h
Amphotericin B	IV	Initial dose: 0.5-1 q24h infuse 2-6h. Increment dose: Increase as tolerated by 0.25-0.5 q24h-48h. Max. 1.5 /day. Test dose: 0.1 mg/kg/dose up to max 1mg, followed by remaining initial dose.				
Ampicillin Meningitis *Group B strep* Other diseases	IV, IM	50 q12h 25 q12h	50 q12h 200/day q8h 25 q12h	50 q8h 75 q6h 25 q8h	50 q8h 200/day q8h 25 q8h	50 q6h 75 q6h 25 q6h
Cefazolin	IV, IM	50 q12h	20 q12h	20 q12h	20 q12h	20 q8h
Cefotaxime	IV, IM	50 q12h	50 q12h	50 q8h	100-150/day q8-12h	150-200/day q6-8h
Ceftazidime	IV, IM		50 q12h	50 q8h	100-150/day q8-12h	50 q8h
Ceftriaxone	IV, IM		50 q24h	50 q24h		50-75 q24h
Cefuroxime	IV, IM	25-50 q12h				
Chloramphenicol	IV, PO		25 q24h	25 q24h	25 q24h	25 q12h

Antibiotics	Routes	Dosages (mg/kg/dose) and Intervals of Administration				
		Weight < 1200g	Weight < 1200g		Weight < 1200g	
		Age 0-4 weeks	Age 0-7 days	>7 days	Age 0-7 days	>7 days
Clindamycin	IV, IM, PO	5 q12h	5 q12h	5 q8h	5 q8h	20-30/day q6-8h
Cloxacillin	IV, IM, PO	15 q6h. Severe infection: 25-50 q12h (1st week life), q8h (2-4 week life), q4-6h (>4 weeks)				
EES	PO	10 q12h	10 q12h	10 q8h	10 q12h	10 q6-8h
Erythromycin	IV	Slow IV (max 5mg/kg/hr) 10 q6h. Severe infection: 15-25 q6h				
Fluconazole	IV	Premature babies: ≤29 weeks gestation: 0-14 days, 5-6 q72h. >14 days,5-6 q48h. 30-36 weeks: 3-6 q48h. Neonates >14 days: Oropharyngeal candidaisis, 6 /day then 3/day. Oesophageal candidiasis, 6/day then 3-12 /day. Systemic candidiasis, 6-12/day Cryptococcal meningitis (acute), 12/day then 6-12/day				
Gentamicin	IV, IM	2.5 q18-24h (<1000g: 3.5 q24h)	2.5 q12h	2.5 q8-12h	2.5 q12h	2.5 q8h
Imipenem	IV, IM	20 q18-24h	20 q12h	20 q12h	20-25 q12h	25 q8h
Meropenem	IV		20 q12h	20 q12h	20 q12h	20 q8h
Metronidazole	IV, PO	7.5 q48h	7.5 q24h	7.5 q12h	7.5 q12h	15 q12h
Netilmicin *	IV, IM		3 q12h	2.5-3 q8h	3 q12h	2.5-3 q8h

Antibiotics	Routes	Dosages (mg/kg/dose) and Intervals of Administration				
		Weight < 1200g	Weight < 1200g		Weight < 1200g	
		Age 0-4 weeks	Age 0-7 days	> 7 days	Age 0-7 days	> 7 days
Benzylpenicillin Meningitis	IV	50,000 u q12h	50,000 u q12h	50,000 u q8h	50,000 u q8h	50,000 u q6h
Group B strep					25,000-450,000 u/day q8h	450,000 u/day q8h
Other diseases		25,000 u q12h	25,000 u q12h	25,000 u q8h	25,000 u q8h	25,000 u q6h
Penicillin G Benzathine	IM		50,000 u (one dose)	50,000 u (one dose)	50,000 u (one dose)	50,000 u (one dose)
Procaine #			50,000 u q24h	50,000 u q24h	50,000 u q24h	50,000 u q24h
Vancomycin	IV	15 q24h	10-15 q12-18h	10-15 q8-12h	10-15 q8-12h	15-20 q8h

Adapted from:

1. Lexi-Comp's Pediatric Dosage Handbook: Including Neonatal Dosing, Drug Adminstration, & Extemporaneous Preparations: Carol K. Taketomo, Donna M. Kraus, Jane H. Hodding, Jane Hurlburt Hodding 2006-2007
2. Drug Doses, 13ed. Frank Shann 2005-2008
3. Product info NetromycinTM Inj. 2006

Avoid using in this age group since sterile abscesses and procaine toxicity occur more frequently with neonates than older patients

Appendix 4

ANTBIOTICS IN PREGNANCY AND LACTATION

Types of Antibiotics	Pregnancy Category (Book on Drugs in Pregnancy and Lactation)
Griseofulvin	C
Terbinafine HCL	B (Manufacturer)
Clotrimazole	B
Tioconazole	NA
Doxycycline	D (Manufacturer)
Tetracycline	D
Minocycline	D
Chloramphenicol	C
Ampicillin	B
Amoxycillin	B (Manufacturer)
Bacampicillin	B (Manufacturer)
Piperacillin	B (Manufacturer)
Benzylpenicillin	B (Manufacturer)
Phenoxymethyl Penicillin	B (Manufacturer)
Procaine Benzylpenicillin	B (Manufacturer)
Benzathine Penicillin	B (Manufacturer)
Cloxacillin	B (Manufacturer)
Ampicillin / Sulbactam	NA
Amoxycillin / Clavulanate	B (Manufacturer)
Piperacillin / Tazobactam	Piperacillin-B (Manufacturer)
Cephalexin Monohydrate	B (Manufacturer)
Cefuroxime Axetil	B (Manufacturer)
Cefuroxime Sodium	B (Manufacturer)
Cefaclor	B (Manufacturer)
Cefotaxime	B (Manufacturer)
Ceftazidime	B (Manufacturer)
Ceftriaxone	B (Manufacturer)
Cefepime	B (Manufacturer)
Cefoperazone / Sulbactam	Cefoperazone-B (Manufacturer)
Cefoperazone	B (Manufacturer)
Meropenem	B (Manufacturer)
Imipenem / Cilastatin	C (Manufacturer)
Trimethoprim	C (Manufacturer)
Sulphamethoxazole / Trimethoprim	Sulphamethoxazole-C (Manufacturer) D (Author)
Erythromycin Lactobionate	B (Manufacturer)
Erythromycin Ethylsuccinate	B (Manufacturer)
Clarithromycin	C (Manufacturer)
Azithromycin	B (Manufacturer)
Clindamycin	B (Manufacturer)
Streptomycin	D (Manufacturer)
Gentamicin	C
Kanamycin	D

Types of Antibiotics	Pregnancy Category (Book on Drugs in Pregnancy and Lactation)
Amikacin	C-(Author) D-Manufacturer
Netilmicin	NA
Ofloxacin	C (Manufacturer)
Ciprofloxacin	C (Manufacturer)
Pefloxacin	NA
Vancomycin	B (Manufacturer)
Fusidic Acid	NA
Metronidazole	B (Manufacturer)
Tinidazole	NA
Nitrofurantoin	B (Manufacturer)
Linezolid	C (Manufacturer)
Amphotericin B	B (Manufacturer)
Miconazole	C (Manufacturer)
Ketoconazole	C (Manufacturer)
Fluconazole	C (Manufacturer)
Itraconazole	C (Manufacturer)
Flucytosine	C (Manufacturer)
Cycloserine	C (Manufacturer)
Rifampicin	C (Manufacturer)
Isoniazid	C
Pyrazinamide	C (Manufacturer)
Ethambutol	B
Rifampicin / Dapsone / Clofazimine	C (Manufacturer)
Clofazimine	C (Manufacturer)
Dapsone	C (Manufacturer)
Acyclovir	B (Manufacturer)
Ribavirin	X (Manufacturer)
Ganciclovir	C (Manufacturer)
Indinavir	C (Manufacturer)
Ritonavir	B (Manufacturer)
Lopinavir / Ritonavir	NA
Zidovudine	C (Manufacturer)
Didanosine	B (Manufacturer)
Stavudine	C (Manufacturer)
Zalcitabine	C (Manufacturer)
Lamivudine	C (Manufacturer)
Zidovudine / Lamivudine	Both-C (Manufacturer)
Nevirapine	C (Manufacturer)
Efavirenz	C (Manufacturer)

NA-Not Available
B/C (Manufacturer)-Manufacturer rated its product in its professional literature

Appendix 5

GUIDE TO COLLECTION AND TRANSPORT OF CLINICAL SPECIMEN

SPECIMEN	COLLECTION CONTAINER	TRANSPORT
Blood	Commercial blood culture bottle	-
CSF	Sterile bijou bottle	Immediately
Ear	Swab	Amies Transport Medium
Eye	Swab	Amies Transport Medium
	Corneal Scrapping	Bacteriologic Culture Plates
Faeces	Clean/Sterile Container	-
	Selenite F broth/Alkaline Peptone Water	-
Genital	Swab	Amies Transport Medium
Nose	Swab	Amies Transport Medium
Sinus	Swab	Amies Transport Medium
Sputum	Sterile Container	-
Peritoneal Fluid	Sterile Container	Within 30 minutes
Throat	Swab	Amies Transport Medium
Tissue	Sterile Container	-
Urine	Sterile Container	Within 30 minutes
Wound (superficial)	Swab	Amies Transport Medium
Wound (deep)	Swab PUS	Amies Transport Medium

Appendix 6

ANTIFUNGAL ACTIVITY SPECTRUM

DRUG	ORGANISMS INHIBITED/CLINICAL SYNDROMES
POLYENES	
Amphotericin B **- Conventional** **- Ampho B lipid complex(ABLC)** **- Ampho B cholesteryl Complex** **- Liposomal Ampho B**	*Aspergillus spp.* *Candida albicans* *Candida glabrata* *Candida parapsilosis* *Candida tropicalis* *Candida krusei* *Candida spp.* *Blastomyces dermatitidis* *Coccidioides immitis* *Cryptococcus spp.* *Fusarium spp.* *Histoplasma capsulatum* *Phycomycetes* *Penicillium marneffei* *Paracoccidioides spp.* *Sporotrichosis* *Zygomycosis* *** *Candida lusitaniae & Candida guilliermondii* are resistant to Amphotericin B
Nystatin	*Aspergillus spp.* *Candida spp.* *Blastomyces spp.* *Coccidioides spp.* *Cryptococcus spp.* *Histoplasma capsulatum* *Phycomycetes* *Paracoccidioides spp.* *Sporotrichosis*
PYRAMIDINE ANALOG	
5-flucytosine	*Cryptococcus spp.* *Candida spp.* *(including Candida glabrata)* Chromoblastomyces

DRUG	ORGANISMS INHIBITED/CLINICAL SYNDROMES
AZOLES	
Ketoconazole	*Dermatophytes* *Candida spp.* *Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis* *Cryptococcus spp*
Miconazole	*Dermatophytes* *Candida spp.* *Pseudollascheria boydii* *Coccidioides immitis* *Cryptococcus spp*
Fluconazole	*Candida spp.* *Candida albicans* *Candida glabrata* *Candida parapsilosis* *Candida tropicalis* *Candida guilliermondi* *Candida lusitaniae* *Crytptococcus spp.* *Blastomyces dermatitidis* *Coccidioides immitis* *Sporotrichosis* ***Candida krusei resistant to fluconazole* ***Fluconazole may require dose escalation when treating Candida glabrata
Itraconazole	*Histoplasma capsulatum* *Blastomyces dermatitidis* *Aspergillus spp.* *Candida spp.* *Candida albicans* *Candida tropicalis* *Candida guilliermondi* *Candida lusitaniae* *Coccidioides immitis* *Sporotrichosis* *Pityriasis versicolor* *Penicillium marneffei* *Onychomycosis* *Chromoblastomycosis (Cladosporium or Fonsecaea)* *Coccidioides immitis* *Cryptococcus spp* ***Candida krusei & Candida glabrata* are resistant to itraconazole

DRUG	ORGANISMS INHIBITED/CLINICAL SYNDROMES
NEWER AZOLES	
Voriconazole	*Aspergillus spp.* *Scedosporium spp.* *Fusarium spp.* *Candida krusei* *Candida spp.* *Candida albicans* *Candida glabrata* *Candida parapsilosis* *Candida tropicalis* *Candida krusei* *Candida guilliermondi* *Candida lusitaniae*
Posaconazole	*Chromoblastomycosis (Cladosporium or Fonsecaea)* *Coccidioides immitis* *Zygomycosis*
ECHINOCANDIN	*ECHINOCANDIN*
Caspofungin	*Candida spp.* *Candida albicans* *Candida glabrata* *Candida parapsilosis* *Candida tropicalis* *Candida krusei* *Candida guilliermondi* *Candida lusitaniae* *Aspergillus spp.*
Micafungin	*Candida spp.* *Candida albicans* *Candida glabrata* *Candida parapsilosis* *Candida tropicalis* *Candida krusei* *Candida guilliermondi* *Candida lusitaniae* *Aspergillus spp.*

DRUG	ORGANISMS INHIBITED/CLINICAL SYNDROMES
DERMATOPHYTOSIS	
Terbinafine	Tinea unguium - *T. rubrum, T. mentagrophytes* Tinea capitis - *T. tonsurans, T. mentagrophytes, T. violaceum - M. audouinii, M. gypsum, M. canis* Tinea corporis - *T. rubrum, T. mentagrophytes, M. canis* Tinea cruris - *T. rubrum, T. mentagrophytes, E. floccosum* Tinea pedis - *T. rubrum, T. mentagrophytes, E. floccusom*
Itraconazole	Tinea unguium - *T. rubrum, T. mentagrophytes* Tinea capitis - *T. tonsurans, T. mentagrophytes, T. violaceum - M. audouinii, M. gypsum, M. canis* Tinea versicolor - *P. ovale, M. furfur*
Fluconazole	Tinea unguium - *T. rubrum, T. mentagrophytes* Tinea capitis - *T. tonsurans, T. mentagrophytes, T. violaceum - M. audouinii, M. gypsum, M. canis* Tinea corporis - *T. rubrum, T. mentagrophytes, M. canis* Tinea cruris - *T. rubrum, T. mentagrophytes, E. floccosum* Tinea pedis - *T. rubrum, T. mentagrophytes, E. floccusom* Tinea versicolor - *P. ovale, M. furfur*
Griseofulvin	Tinea capitis - *T. tonsurans, T. mentagrophytes, T. violaceum - M. audouinii, M. gypsum,M. canis* Tinea corporis - *T. rubrum, T. mentagrophytes, M. canis* Tinea cruris - *T. rubrum, T. mentagrophytes, E. floccosum*
Ketoconazole	Tinea corporis - *T. rubrum, T. mentagrophytes, M. canis* Tinea cruris - *T. rubrum, T. mentagrophytes, E. floccosum* Tinea pedis - *T. rubrum, T. mentagrophytes, E. floccusom* Tinea versicolor - *P. ovale, M. furfur*

PERCENTAGE OF SPECIFIC RESISTANT OF SPECIFIC BACTERIA (2002 - 2005)

	MRSA				VRSA				PPNG				Spectinomycin R NG				Chloramphenicol R HI				Ampicillin R HI				Penicillin R Strep pneumo				Chloramphenicol R S.typhi				Tetracyline R V. cholera				Penicillin R Strep Gp A				Penicillin R Strep Gp B				VRE			
	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005
HRPZII	24.2 (1126)	11.6 (1064)	4.9 (1396)	-	0 (273)	0 (1064)	0 (1396)	-	-	-	40 (10)	-	-	-	12.5 (8)	-	19.4 (31)	16.8 (190)	21.3 (75)	-	25.8 (31)	16.7 (32)	26.6 (75)	-	20 (10)	3 (39)	2.2 (46)	-	0 (100)	0 (215)	0 (80)	-	-	-	0	-	11.3 (124)	25 (8)	1.3 (156)	-	32.3 (116)	0 (8)	1.5 (128)	-	0 (5)	0 (21)	0 (260)	-
HPP	45.7 (1407)	42 (1566)	37 (1977)	32.4 (1689)	0 (644)	0 (1566)	0 (1977)	0 (547)	56 (25)	40 (10)	37.5 (8)	40 (5)	0 (25)	0 (10)	0 (8)	0 (5)	9.1 (11)	0 (6)	0 (8)	0 (11)	0 (11)	16.7 (12)	37.5 (8)	20 (15)	14.8 (27)	26.8 (41)	17 (47)	23 (64)	0 (1)	0 (4)	-	0 (7)	-	-	-	-	0 (11)	0 (12)	0 (16)	0 (59)	2.5 (39)	0 (242)	0 (320)	0 (306)	0 (92)	0 (151)	0 (140)	0 (242)
HKL	38.6 (3708)	43.9 (4287)	44.3 (3780)	46.4 (4252)	0 (1587)	0 (3948)	0 (3780)	0 (4252)	37.5 (8)	38.7 (94)	0 (20)	33.3 (3)	-	0 (18)	0 (20)	-	8.3 (108)	3.2 (188)	4 (145)	14.5 (221)	19.8 (111)	13.8 (188)	12 (145)	10.9 (221)	17.3 (156)	19 (121)	16 (105)	35.6 (135)	0 (4)	0 (11)	0 (5)	0 (3)	0 (9)	0 (1)	-	-	0 (160)	0 (141)	0 (44)	0 (132)	0 (1976)	0 (1621)	0 (717)	4.5 (1004)	0 (553)	1.1 (556)	1 (681)	2.2 (869)
HTAR	35.3 (1144)	-	20.6 (1025)	-	0 (1131)	-	0 (1016)	-	0 (2)	-	43 (7)	-	-	-	0 (7)	-	5.1 (39)	-	28 (25)	-	35.9 (39)	-	32 (25)	-	9.1 (22)	-	0 (23)	-	0 (9)	-	0 (8)	-	0 (78)	-	-	-	1.1 (94)	-	0 (108)	-	15 (399)	-	0 (711)	-	0 (123)	-	0 (73)	-
HSAJB	40.2 (2952)	30.6 (1768)	26.4 (2155)	26.2 (3015)	0 (2759)	0 (3324)	0 (2155)	0 (3015)	-	0 (20)	31.3 (32)	0 (4)	-	0 (15)	0 (32)	0 (4)	12.2 (49)	3 (47)	3.1 (32)	0 (36)	14 (50)	12 (49)	12.5 (32)	2.7 (37)	29.6 (54)	16 (57)	13.7 (51)	1.1 (89)	0 (7)	13 (16)	0 (5)	0 (12)	-	-	-	-	0 (184)	1 (226)	0.6 (157)	0 (171)	0 (262)	1 (541)	0.6 (505)	0.4 (735)	0.3 (351)	0 (327)	0 (301)	0 (373)
HMEL	22.5 (2952)	18.6 (1609)	15.7 (2149)	16.6 (940)	0 (1696)	1.9 (1609)	1.6 (369)	0 (1071)	0 (7)	0 (2)	0 (9)	-	0 (7)	0 (1)	0 (6)	0 (11)	0 (1)	-	0 (4)	0 (3)	0 (1)	-	0 (4)	33.3 (3)	0 (8)	18.2 (11)	6.5 (6.5)	6.9 (29)	-	0 (1)	0 (4)	0 (2)	0 (56)	-	-	-	0 (75)	16.3 (44)	3.8 (79)	0 (11)	0 (222)	12 (162)	5.2 (210)	1.7 (58)	0 (134)	7 (147)	3.5 (114)	0 (1)
HTAA	27.5 (524)	24.5 (8654)	25.5 (1198)	22.5 (1376)	0 (150)	0 (836)	0 (1198)	0 (1376)	-	-	-	-	-	-	-	-	9.4 (32)	5.2 (58)	8.6 (37)	0 (31)	23.3 (30)	9.1 (55)	5.4 (37)	13.3 (31)	0 (10)	0 (22)	0 (31)	0 (31)	0 (4)	0 (6)	0 (4)	0 (8)	0 (5)	-	-	-	15.6 (45)	0 (62)	0 (88)	0 (77)	11.7 (180)	1.1 (278)	0 (213)	0 (307)	0 (19)	0 (41)	0 (52)	0 (61)
HQE	26.8 (2586)	21.2 (1087)	-	19 (353)	0 (694)	0 (290)	-	0 (353)	33.3 (13)	-	-	-	0 (13)	1 (11)	-	-	0 (139)	0 (26)	-	9.1 (11)	0 (139)	0 (26)	-	0 (11)	1.4 (71)	0 (29)	-	6 (14)	0 (42)	0 (23)	-	0 (6)	0 (507)	0 (18)	-	0 (65)	0 (142)	0 (38)	-	0 (18)	0 (1)	-	-	0 (7)	9.1 (11)	4.7 (21)	-	0 (18)
HIPH	34 (2172)	-	24 (1763)	-	0 (2172)	0 (1802)	-	-	25 (8)	-	33 (9)	-	0 (8)	-	0 (9)	-	5.4 (37)	-	0 (18)	-	21.4 (42)	-	0 (18)	-	10 (30)	-	17 (36)	-	0 (7)	-	0 (12)	-	0 (7)	-	-	-	0 (192)	-	0 (52)	-	4.7 (171)	-	1 (423)	-	0 (182)	-	0 (251)	-
HTJ	28.5 (1822)	25.2 (1457)	28.8 (1241)	23.3 (854)	0 (1196)	0 (1457)	0 (1240)	0 (855)	100 (1)	-	-	0 (1)	0 (1)	1 (5)	-	0 (1)	0 (4)	0 (3)	0 (1)	0 (1)	50 (4)	-	100 (1)	0 (1)	3 (66)	0 (31)	9 (22)	0 (12)	0 (4)	0 (2)	0 (3)	0 (1)	-	-	-	-	0 (93)	5.6 (36)	4.2 (24)	0 (45)	0 (318)	5.2 (495)	6.6 (166)	1.7 (238)	0 (48)	0 (133)	0 (137)	0 (74)
HSB	23.6 (2195)	24.2 (2229)	23.63 (2196)	19.9 (2430)	0 (2195)	0 (2229)	0 (2196)	0 (2430)	30 (10)	-	66.7 (6)	0 (16)	0 (10)	-	0 (6)	0 (16)	0 (105)	3.1 (95)	0.5 (187)	0 (187)	10.5 (105)	6.3 (95)	6.4 (187)	5.3 (187)	0 (63)	0 (32)	0 (42)	9.3 (54)	0 (1)	0 (6)	0 (6)	0 (7)	-	-	0 (72)	-	0 (88)	0 (54)	0 (77)	0 (46)	0 (311)	0 (12)	0 (736)	0 (671)	0 (22)	0 (148)	0.3 (316)	0 (361)
HSEL	-	34.7 (1125)	26.6 (1293)	18.5 (757)		0.1 (1081)	0 (1288)	0 (755)		-	0 (1)	-		-	-	-		16.7 (6)	10 (10)	5.6 (18)		16.7 (6)	40 (10)	5.6 (18)		0 (24)	42.9 (14)	25 (44)		0 (3)	0 (2)	0 (3)		-	-	-		0 (49)	0 (87)	0 (80)		0 (866)	0 (526)	0 (450)		0 (121)	1.8 (217)	0 (183)
HSNZ	-	12.12 (1138)	10.1 (962)	-		0.18 (1138)	0 (996)	-		-	-	-		-	-	-		5.36 (56)	4.8 (21)	-		22.2 (27)	9.1 (22)	-		0 (1)	3 (33)	-		0 (4)	0 (7)	-		-	-	-		1.87 (107)	0 (53)	-		3.7 (94)	0 (568)	-		3.1 (32)	-	-
HTF	-	13.6 (418)	10.3 (427)	12 (366)		7 (399)	2.7 (401)	0 (366)		-	-	-		-	-	-		-	0 (3)	-		-	0 (3)	0 (3)		0 (4)	0 (8)	0 (6)		-	0 (1)	-		-	-	-		23.8 (21)	10 (42)	3.7 (27)		39.4 (94)	10 (86)	9.5 (124)		-	0 (15)	0 (17)
HUS	6.9 (1011)	-	10.3 (1194)	16.3 (940)	0 (1011)	-	0 (366)	0 (906)		-	-	-		-	-	-		-	0 (1)	-		-	100 (1)	-		-	0 (9)	0 (7)		-	-	0 (5)		-	-	-	3.2 (62)	-	2.4 (82)	5 (60)	0 (47)	-	10.2 (59)	11.6 (86)	0 (40)	-	3.8 (79)	3 (70)

HPP - Hospital Pulau Pinang
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HIPH - Hospital Ipoh
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HSNZ - Hospital Sultanah Nur Zahirah
HTF - Hospital Tuanku Fauziah

* - Not verified
ND -no data

PEPERCENTAGE OF ANTIBIOTIC RESISTANCE OF SPECIFIC BACTERIA
2006 - 2007

Hospital		Staph aureus		N.gonorrhoeae		N.gonorrhoeae		H.influenzae		H.influenzae		S.pneumoniae		S.Typhi		V.cholerae		GrpA Strep		GrpB Strep		Enterococci	
		(MRSA)		(PPNG)		Spectinomycin R		Chloram R		Ampicillin R		Penicillin R		Chloramphenicol R		Tetracycline R		Penicillin R		Penicillin R		Vancomycin R	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
HPP	%R	36	37.6	ND	53.3	0	0	9.1	3.1	0	35.3	19.3	30	0	45.5	ND	100	0	0	0	2.7	0	1.1
	No. tested	1702	1749	ND	15	3	7	22	32	18	34	31	30	1	11	ND	2	41	70	494	406	219	185
HKL	%R	46.8	44.1	100	0	ND	0	24.1	33.8	8.4	20	0	1.2	0	0	ND	0	0	0	0	0.1	1.6	0
	No. tested	4377	4280	3	0	ND	0	166	65	166	65	89	81	5	2	ND	0	111	123	1222	800	757	33
HTAR	%R	15.6	13.3	57.1	75	0	0	13.7	7.1	19.2	10.7	37	0	33.3	0	0	ND	0	0	0	0	0	0
	No. tested	1038	916	7	8	2	1	51	28	52	28	54	42	6	4	2	ND	126	109	573	579	218	24
HSAJB	%R	27	26.9	50	55.6	0	0	0	0	17	24.1	1.4	23.1	0	0	0	0	1	0.5	2	0.1	0	0
	No. tested	3258	3072	6	9	5	0	47	23	47	54	70	65	14	4	0	0	209	202	679	831	209	29
HMEL	%R	28.8	24.7	0	0	0	0	0	0	0	30	21.1	11.1	0	0	0	0	11.4	5.9	27.7	19.9	0	0
	No. tested	1799	2380	0	2	0	0	2	11	2	10	6.9	45	3	5	1	3	44	101	242	682	46	49
HTAA	%R	21.1	18.3	0	100	ND	0	3.2	1.4	12.9	23.3	7.7	11.1	ND	30.8	0	0	2.6	0	2.2	2.1	0	0
	No. tested	1376	971	0	1	ND	0	31	69	31	60	26	9	ND	13	0	0	77	81	320	332	41	0
HIPH	%R	ND	24.4	ND	ND	ND	ND	ND	5.9	ND	0	ND	36	ND	45.5	ND	0	ND	0.6	ND	0.6	ND	0.8*
	No. tested	ND	2058	ND	ND	ND	ND	ND	17	ND	17	ND	39	ND	11	ND	0	ND	170	ND	668	ND	379
HTJ	%R	ND	12.9	ND	0	ND	0	ND	0	ND	0	ND	0	ND	4	ND	0	ND	0	ND	0	ND	0
	No. tested	ND	854	ND	0	ND	0	ND	3	ND	3	ND	28	ND	6	ND	0	ND	65	ND	548	ND	222
HSB	%R	26.7	21.9	38.5	35.7	0	0	2.7	0	5.8	17.8	11.7	0	0	0	0	0	0	6.8	0	0	0	0
	No. tested	2472	1639	13	14	13	14	259	129	259	129	60	44	3	6	79	0	51	132	792	968	476	424
HSEL	%R	28.4	28.6	0	0	0	ND	0	0	0	0	2.4	0	0	0	0	0	0	0	0	0	1.9	0
	No. tested	1298	1201	0	1	0	ND	7	6	7	6	42	18	4	2	0	0	116	47	328	482	255	298
HSNZ	%R	9.8	6.8	0	100	0	0	0	0	5.8	40	27.3	0	0	0	0	0	2.9	11	2.3	1	0	0
	No. tested	764	687	0	1	1	1	17	6	17	5	33	27	0	1	0	0	68	55	622	687	23	0
HTF	%R	13.3	8.7	0	100	0	0	0	0	0	0	0	0	0	100	0	0	4.2	0	7.7	0	0	25*
	No. tested	369	289	0	2	1	0	4	0	4	0	5	3	0	1	0	0	24	45	130	196	19	4

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* - Not verified
ND -no data

Appendix 8 (i)

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM NEGATIVE BACTERIA (2003-2005)

Organism	Amikacin			Ampicillin			Amoxicillin/Clavulanic Acid			Cefuroxime			Cefoperazone			Ceftriaxone		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
A. baumanii	8.8 (1208)	18.3 (2761)	19.3 (3255)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Escherichia coli	2 (6519)	1.4 (8316)	5 (9636)	65.2 (8022)	66.3 (13241)	69.7 (12323)	17.7 (6413)	15.3 (11144)	21 (11402)	10.6 (5592)	11.1 (8934)	16 (7471)	10.7 (5028)	11.1 (7641)	17 (6948)	8.5 (5446)	9.5 (9412)	11.1 (10656)
Haemophilus influenzae	-	-	-	11.5 (366)	15 (454)	9.5 (412)	2.5 (326)	4.5 (402)	5.7 (401)	-	-	-	-	-	-	0.3 (317)	4.4 (427)	1.7 (410)
Klebsiella pneumoniae	9.7 (5292)	5.3 (7936)	7.9 (7873)	98.3 (6414)	98.2 (12650)	98.9 (11126)	18.3 (5114)	18.6 (11540)	21 (9936)	28.2 (3622)	25.4 (7467)	27.1 (6083)	20.7 (4747)	18.7 (9974)	19.7 (8399)	22.7 (4099)	22.1 (9511)	20.3 (9431)
Pseudomonas aeruginosa	11.9 (8229)	9.1 (12658)	9 (10382)	-	-	-	84.7 (72)	91.5 (809)	97.1 (1902)	-	-	-	-	-	-	-	-	-
Burkholderia pseudomallei	-	-	78 (123)	-	-	-	-	-	5.5 (164)	-	-	-	-	-	-	-	-	-
Salmonella sp.	-	-	-	16.8 (435	13.7 (779)	26.5 (691)	-	-	-	-	-	-	-	-	-	0.6 (360)	1.9 (636)	3.1 (511)
Stenotrophomonas maltophilia	39.7 (365)	31.6 (399)	49.8 (289)	-	-	-	82.4 (91)	71.4 (399)	82.7 (382)	-	-	-	-	-	-	-	-	-

Organism	Ceftazidime			Cefotaxime			Cefepime			Chloramphenicol			Ciprofloxacin		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
A. baumanii	35.4 (1206)	40.1 (3222)	48.3 (3409)	-	-	-	31 (832)	36.3 (2278)	51.3 (2681)	-	-	-	22.9 (1209)	40.8 (2465)	36.2 (3064)
Escherichia coli	6.4 (7504)	7.4 (11129)	9.3 (11364)	6.8 (5668)	8.5 (9183)	10.8 (9268)	5.3 (1726)	6.7 (4044)	7.5 (6445)	-	-	-	13.9 (6864)	15 (10951)	16.9 (10850)
Haemophilus influenzae	-	-	-	0.6 (359)	2.6 (426)	3 (401)	-	-	-	3.3 (366)	4.8 (419)	7.9 (407)	-	-	-
Klebsiella pneumoniae	21.8 (6155)	20.5 (11225)	19.3 (10406)	19.5 (5216)	19.8 (9481)	19 (9049)	15.6 (2826)	18.8 (4939)	20.2 (5434)	-	-	-	8.8 (5708)	9.3 (9776)	9.7 (9782)
Pseudomonas aeruginosa	16.2 (8236)	13.7 (12120)	15 (10325)	-	-	-	17.7 (3441)	18.5 (5779)	12.3 (7078)	-	-	-	15.8 (7333)	13.1 (11526)	11.1 (9901)
Burkholderia pseudomallei	-	-	4.4 (181)	-	-	-	-	-	5.6 (36)	-	-	-	-	-	14.8 (155)
Salmonella sp.	-	-	-	-	-	-	-	-	-	6.9 (420)	5 (734)	6.3 (666)	0.7 (409)	0.5 (606)	1.1 (658)
Stenotrophomonas maltophilia	36.1 (465)	29.9 (489)	33.2 (371)	-	-	-	60.8 (125)	32.6 (144)	21.4 (192)	-	-	-	10.2 (499)	8.8 (568)	4 (545)

Organism	Trimethoprim/Sulfamethaxole			Gentamicin			Imipinem			Meropenem			Netilmicin			Nitrofurantoin		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
A. baumanii	-	-	-	39.1 (1371)	42.1 (3287)	43.6 (3282)	29.3 (1387)	35 (3402)	40.3 (3323)	-	-	-	-	-	-	-	-	-
Escherichia coli	45.4 (8540)	45.9 (12527)	45.7 (11454)	10.7 (7821)	10.4 (12137)	14.5 (10963)	0.4 (7398)	0.2 (11277)	0.6 (11496)	0.5 (661)	0.5 (3090)	-	6.4 (3568)	3.5 (5739)	5 (5419)	5.5 (3346)	3.3 (5786)	8.4 (6139)
Haemophilus influenzae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klebsiella pneumoniae	26.4 (6647)	24.8 (11514)	24.1 (10209)	21.2 (6152)	18.2 (11485)	17.5 (9876)	0.9 (6209)	0.5 (11568)	0.7 (10427)	1.1 (1046)	1 (3949)	-	16.9 (4101)	13.9 (7775)	13.3 (6555)	32.6 (954)	18 (2123)	32 (2046)
Pseudomonas aeruginosa	-	-	-	22 (7934)	18.5 (12122)	18.8 (9971)	13.2 (8020)	11.3 (1221)	11.1 (10322)	-	-	-	18.7 (4651)	13.8 (6138)	17.8 (7375)	-	-	-
Burkholderia pseudomallei	-	-	83.1 (162)	-	-	95.3 (129)	-	-	0.7 (134)	-	-	-	-	-	87.9 (91)	-	-	-
Salmonella sp.	15.8 (438)	15.1 (762)	21.6 (671)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stenotrophomonas maltophilia	6.1 (522)	9.7 (672)	9.6 (498)	43.3 (418)	47.6 (599)	54 (487)	97.1 (489)	87.2 (585)	92.5 (469)	-	-	-	35.5 (141)	19.6 (209)	27.1 (140)	-	-	-

Organism	Cefoperazone/Sulbactam			Tetracycline			Ampicillin/Sulbactam			Cephalexin			Piperacillin/Tazobactam		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003*	2004*	2005
A. baumanii	-	-	14 (2562)	-	-	-	-	-	40.7 (3758)	-	-	-	19.2 (125)	34.7 (343)	49.1 (795)
Escherichia coli	-	-	2.7 (3226)	-	-	-	-	-	38.6 (5025)	20.3 (3432)	18.8 (5631)	17 (5641)	27.9 (265)	24.2 (422)	10.2 (1566)
Haemophilus influenzae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klebsiella pneumoniae	-	-	9 (2358)	-	-	-	-	-	28.2 (6700)	21.1 (2485)	23 (5701)	21.1 (4789)	22.8 (412)	12.1 (749)	16.8 (1076)
Pseudomonas aeruginosa	-	-	-	-	-	-	-	-	-	-	-	-	16.9 (7343)	12.9 (8411)	15 (5754)
Burkholderia pseudomallei	-	-	-	-	-	-	-	-	1.8 (55)	-	-	-	-	-	3.6 (28)
Salmonella sp.	-	-	-	37.3 (244)	41.1 (333)	42.9 (438)	-	-	-	-	-	-	-	-	-
Stenotrophomonas maltophilia	-	-	-	-	-	-	-	-	-	-	-	-	62.8 (290)	64.5 (211)	31.5 (89)

* - previously tested with Piperacillin

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM NEGATIVE BACTERIA
2006

Organism	Amikacin	Amoxicillin/Clavulanic acid	Ampicillin	Ampicillin/ Sulbactam	Cefepime	Cefoperazone	Cefoperazone/ Sulbactam	Cefotaxime	Ceftazidime	Ceftriaxone	Cefuroxime sodium	Cephalexin	Chloramphenicol	Ciprofloxacin	Gentamicin	Imipenem	Meropenem	Netilmicin	Nitrofurantoin	Piperacillin	Piperacillin/ Tazobactam	Tetracycline	Trimethoprim/ Sulfamethoxazole
A. baumannii	23.5 [3300]	70.6 [798]	92.9 [911]	43.3 [3159]	50.7 [3041]	73.1 [1316]	22.9 [26311]	74.5 [924]	41.8 [3352]	83.1 [803]	90.3 [872]			41.9 [3177]	41 [3371]	44.5 [3289]	47 [1344]	15.1 [2543]	84.3 [89]	56.4 [1582]	49 [439]		40.7 [852]
C. fruendii	6.1 [147]	74.8 [147]	85.8 [169]	64 [86]	22.6 [93]	39.3 [122]	10.3 [29]	41.4 [145]	38.2 [170]	43.7 [126]	60.6 [137]	73.8 [65]		37 [162]	38.8 [170]	1.2 [168]	4.4 [45]	22.8 [92]	15.2 [46]	47.6 [21]	28.6 [21]		56.1 [164]
Enterobacter sp.	2.6 [1349]	65 [1705]	88.2 [1761	64.3 [972]	6.3 [1605]	18.6 [1298]	0.5 [643]	16.8 [10511]	15.2 [1757]	19 [1682]	37.9 [1727]	8.4 [758]	28.6 [42]	9.8 [1712]	11.5 [1762]	0.4 [1708]	0.6 [1239]	27.7 [891]	20 [451]	17.6 [85]	34.2 [691]		24.8 [1759]
Escherichia coli	2.3 [10101]	21.4 [10476]	68.6 [12470]	44.3 [5001]	10 [6659]	18.2 [7599]	4.6 [2403]	12.5 [10253]	10.4 [12489]	14 [9823]	20.2 [10431]	18.5 [4840]	16.6 [512]	19.6 [10627]	12.7 [12435]	0.3 [11802]	0.5 [5670]	11 [5673]	5.6 [5673]	57.4 [1708]	17.5 [1795]	41.7 [24]	46.3 [12448]
E. coli (Urine)	0.9 [3710]	15 [3440]	67.7 [4458]	37.6 [442]	5.9 [2412]	13.9 [979]	5.1 [216]	9.9 [4252]	7.2 [4455]	11.3 [3422]	13.6 [3860]	25.3 [1434]	0 [15]	20.6 [4252]	12 [4449]	0.3 [4245]	0.6 [1977]	4.9 [1412]	4.1 [4404]	61.4 [140]			48.3 [4454]
E. coli (Non urine)	2.7 [3338]	21.3 [3788]	68.9 [4784]	53 [2331]	12.6 [2557]	17.8 [4605]	1.6 [1096]	15.1 [3564]	13.3 [4764]	16.9 [3667]	20.5 [4139]	9.9 [1990]	17.5 [469]	18.5 [4347]	13.8 [4734]	0.3 [4318]	0.5 [1498]	16 [2844]		55.7 [314]		57.1 [14]	44.5 [4776]
H. influenzae		3.5 [395]	11.7 [497]	9.3 [54]				1.2 [491]		1 [496]	1.6 [128]		11.3 [497]	0 [22]	0 [8]	9.8 [41]	10.3 [29]					3.8 [52]	39.9 [316]
H. influenzae (Invasive)		4.8 [21]	10.7 [28]					7.1 [28]		3.6 [28]	0 [5]		0 [24]			40 [5]	42.9 [7]						14.3 [14]
H. influenzae (Non invasive)		3.5 [374]	11.7 [469]	7.8 [51]	0 [3]			0.9 [463]	14.3 [7]	0.9 [468]	1.6 [123]		11.8 [473]	0 [22]	0 [7]	5.6 [36]	0 [22]					2 [50]	41.1 [302]
K. pneumoniae	7 [8721]	23.1 [9872]	98.7 [11538]	31.8 [7044]	25.5 [5306]	20.1 [9680]	20.4 [1554]	18.5 [10357]	18.4 [11592]	20.9 [9017]	28 [9800]	24 [3390]	13.9 [711]	11.8 [10490]	15 [11544]	0.7 [10873]	1.4 [4337]	17.7 [6028]	32.5 [1719]	45.3 [2926]	19.7 [1237]		22.9 [11501]
M. morgannii	1.8 [388]	91.4 [453]	95.2 [526]	59.9 [1314]	2.3 [261]	6.2 [421]	4.3 [70]	6.4 [467]	5 [535]	6.8 [400]	66 [456]	84.4 [179]	31 [29]	9.3 [482]	14.3 [532]	0.8 [494]	1.2 [161]	5.5 [290]	72 [82]	12.2 [98]	3.3 [60]		29.7 [519]
P. aeruginosa	8.9 [11733]	96.7 [2421]	97.9 [292]	90.7 [248]	14.2 [8419]	18.5 [7085]	16.2 [4494]	60.2 [993]	14.5 [11882]	42 [181]	91 [288]	4.8 [42]	81.8 [198]	11.7 [11437]	16.7 [11775]	13.4 [11722]	16 [6190]	18.9 [6063]	92.3 [143]	15.1 [4688]	11.5 [7631]		80.7 [353]
B. pseudomallei	82.3 [192]	11.4 [167]	94.7 [75]	5.7 [87]	12.2 [82]	6.3 [143]	4.3 [46]	11.8 [51]	1.8 [228]	27.6 [58]	74 [73]		6.8 [88]	25 [204]	95.5 [201]	1.5 [202]	4.7 [64]	88.6 [132]		4.3 [69]	7.9 [89]	18.6 [118]	58.3 [180]
P. mirabilis	3 [1826]	14.6 [2397]	46.5 [2607]	19.1 [1883]	4.3 [1343]	6.7 [2159]	6.2 [336]	4.6 [2205]	2.4 [2631]	5.1 [2176]	17.2 [2137]	22.4 [812]	56.7 [90]	9.1 [2434]	12.2 [2616]	1 [2544]	1.1 [995]	8.1 [1413]	89.7 [348]	17 [693]	2.5 [318]		40 [2597]
Salmonella sp	0 [67]	1.8 [57]	19.3 [782]	9.1 [33]	0 [20]	2.4 [85]	0 [12]	0 [72]	0 [84]	1.7 [604]	3.6 [83]		5.7 [750]	0.5 [739]	4.2 [96]	0 [56]	0 [32]	0 [14]	40 [5]	19 [21]		50.8 [429]	23.1 [785]
S. marcescens	4.6 [240]	88.4 [268]	90.7 [332]	89.5 [191]	2.5 [157]	6.3 [300]	0 [48]	5.5 [292]	3.8 [345]	6.4 [233]	81.7 [312]	73.1 [108]	27.3 [66]	1.1 [278]	4.1 [341]	0.7 [279]	2 [102]	6.7 [149]	84 [25]	7.7 [52]	41.5 [41]	5.1 [332]	76.2 [21]
S. maltophilia	39.8 [535]	82.3 [515]	94.4 [248]	81.9 [288]	37.9 [369]	37.8 [349]	22.2 [162]	75.9 [212]	26.6 [627]	86.7 [233]	94.8 [248]		42.9 [21]	11.8 [701]	55 [647]	93 [683]	79.4 [393]	32.6 [282]		65.5 [357]		76.1 [184]	6.8 [732]

[ ] No. tested

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM NEGATIVE BACTERIA
2007

Organism	Amikacin	Amoxicillin/ Clavulanic acid	Ampicillin	Ampicillin/ Sulbactam	Cefepime	Cefoperazone	Cefoperazone/ Sulbactam	Cefotaxime	Ceftazidime	Ceftriaxone	Cefuroxime sodium	Cephalexin	Chloramphenicol	Ciprofloxacin	Gentamicin	Imipenem	Meropenem	Netilmicin	Nitrofurantoin	Piperacillin	Piperacillin/ Tazobactam	Tetracycline	Trimethoprim/ Sulfamethoxazole
A. baumannii	29.2	62.3	94.7	38.3	53.2	77.8	14.4	75.4	46.8	83.2	85.5	94.1	79.6	43.9	36.4	46.6	47.7	19.3		53.9	47.5		37.8
	[4298]	[871]	[890]	[4241]	[4302]	[1448]	[3236]	[921]	[3987]	[802]	[874]	[34]	[54]	[3880]	[4176]	[4916][	[2593]	[2093]		[1685]	[2333]		[1446]
C. fruendii	5.9	70.8	80.6	49	25.5	19.2	11.3	30.3	29	34.1	36.6	86.9		15.3	20.8	1.4*	1.9*	30.7		29.4	19.7		39.6
	[202]	[212]	[227]	[98]	[94]	[130]	[53]	[142]	[207]	[182]	[186]	[61]		[203]	[221]	[219]	[155]	[75]		[34]	[61]		[225]
Enterobacter sp.	3.2	83.6	93.2	57.5	5.7	15.9	12.8	19.4	17.8	21.4	35.5	79	25	4.4	7.8	1*	1.2*	8.8	25.1	29.5	13.7		22
	[2073]	[2082]	[2314]	[958]	[871]	[1646]	[468]	[1781]	[2174]	[1740]	[1995]	[834]	[176]	[2105]	[2246]	[2156]	[1210]	[873]	[335]	[380]	[582]		[2266]
E.coli (all)	2.2	21.7	69.3	34.9	23.3	18.1	7.1	15.1	15.2	16.3	19.6	25.8	24.8	18	11.7	0.4*	0.2*	6.3	6.5	51.2	5.8		44.1
	[10296]	[11341]	[13239]	[4903]	[4916]	[6751]	[2817]	[10321]	[11479]	[9720]	[11427]	[4033]	[596]	[11610]	[12760]	[11854]	[6783]	[4343]	[5448]	[2279]	[3230]		[13080]
E. coli (Urine)	1.9	17.6	68.4	29.6	19.9	17.2	5.9	12.7	13.6	15	15.5	26.8	21.6	19.9	11.8	0.4*	0.2*	5.6	6.6	56.5	4.5		46.8
	[3927]	[4220]	[5438]	[1154]	[1698]	[1344]	[1093]	[4171]	[4584]	[3429]	[4516]	[2144]	[111]	[4902]	[5300]	[4716]	[2723]	[1853]	[5300]	[619]	[1114]		[5436]
H.influenzae (all)		6.5	20.1	9.3				5.6		4.7	5.1		8.6	0	9.1	9.5	7.7						32.2
		[306]	[348]	[54]				[322]		[343]	[137]		[326]	[43]	[11]	[63]	[65]						[255]
H.influenzae (Invasive)		4	19.4					3.6		0			2.7			0							22.2
		[25]	[36]					[28]		[33]			[37]			[15]							[18]
K. pneumoniae	6.4	24.8	98.9	33	38.4	21.6	15.3	23.4	24.4	25.7	29.6	27.7	16.5	12.5	17.7	0.5*	0.8*	17.8	26	36.1	12.8		27
	[12067]	[13741]	[15141]	[8003]	[6457]	[10045]	[2912]	[12154]	[13890]	[11926]	[13628]	[3512]	[832]	[13551]	[14501]	[13973]	[8327]	[5010]	[2516]	[3067]	[4784]		[14746]
M. morgannii	1.2	89.4	93.3	65.3	1.7	6.8		9.4	4.6	6.1	74.9			12	12.7	0.3	1.2						32.9
	[576]	[667]	[716]	[354]	[350]	[400]		[587]	[636]	[604]	[654]			[598]	[669]	[671]	576						[703]
P. aeruginosa	8.1	97.9	94.8	97	13.4	16.1		53.5	13.7	6.7	91.5	58.3	78.3	11.5	12.5	13.5	13.3	15	96	11.8	8.9		94.3
	[15065]	[2986]	[173]	[1366]	[10687]	[7823]		[864]	[14321]	[85]	[176]	[24]	[166]	[14057]	[14666]	[14941]	[10600]	[6850]	[149]	[4810]	[13556]		[1454]
B. pseudomallei	88	5.9	96.5	2.9	8.2	3.8	0.9	4.2	2.8	16.7	79.1		5.1	20.7	97.1	0.3*	2.8*	90.3		2.3	0.9	10	45
	[325]	[220]	[85]	[137]	[159]	[183]	[107]	[72]	[358]	[60]	[91]		[138]	[305]	[313]	[371]	[212]	[134]		[131]	[215]	[160]	[269]
P. mirabilis	1.4	12.7	48.1	13.1	9.9	7.6		6	6.2	6.5	18.1	31.6	52.2	11.3	11.4	1.8*	1*	6.6	90.6		1.4		39.4
	[2573]	[3185]	[3376]	[2101]	1502]	[2217]		[2608]	[3135]	[2856]	[2943]	[737]	[90]	[3103]	[3292]	[3241]	[1928]	[1142]	[498]		[1216]		[3284]
Salmonella sp	0	9.1	24.8	7	0	1.1		0.9	0.9	1.2	9.6	6.2	5.8	1.4	1.7	0	0	5.3	25	18.6	4.4	36.9	19.9
	[128]	[110]	[1015]	[57]	[26]	[94]		[107]	[112]	[914]	[114]	[16]	[831]	[858]	[119]	[110]	[87]	[19]	[16]	[43]	[68]	[453]	[1011]
S. marcescens	15.5	85	97.3	86.5	4.9	2.4	8.9	6.7	7.6	5.8	80.7	85.9	19.6	1	13.6	3.3*	3.4*	3.9	82.8	7.5	2.3	94.4	19.6
	[434]	[472]	[518]	[260]	[265]	[330]	[146]	[436]	[474]	[413]	[481]	[142]	[511]	[418]	[492]	[481]	[264]	[154]	[29]	[93]	[129]	[19]	[511]
S. maltophilia	40.1	88.1	97.8	91.3	48.9	52.3	48.8	86.7	35.7	91.2	94.1		27.3	8.7	46.7	94.2	89.7	33		79.5	50.8	77.5	7
	[664]	[489]	[186]	[436]	[417]	[333]	[213]	[181]	[658]	[160]	[187]		[11]	[801]	[788]	[862]	[565]	[303]		[327]	[510]	[213]	[791]

[ ] No. tested

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM POSITIVE BACTERIA
2003-2005

Organism	Ampicillin			Chloramphenicol			Ceftriaxone			Ciprofloxacin			Clindamycin			Trimethoprim/Sulfamethaxole			Erythromycin			Gentamicin			Gentamicin 120			Nitrofurantoin*			Tetracycline			Rifampicin			Vancomycin			Oxacillin			Penicillin			Fusidic Acid			Mupirocin		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
Staphylococcus, coagulase negative	38.1 (42)	77.43 (518)	38.1 (42)	14.6 (295)	14.4 (132)	8.7 (298)	-	-	-	-	-	-	-	-	17.3 (1294)	44.7 (2319)	43.8 (3249)	40.3 (3626)	50.7 (2801)	50.9 (4218)	50 (4834)	44.9 (2897)	43.6 (4175)	41.9 (4707)	-	-	-	7.1 (56)	6.8 (88)	18.8 (183)	-	-	-	18 (2796)	15.4 (4331)	18.8 (183)	0.2 (2861)	0.2 (2861)	0.3 (4957)	58.5 (2947)	61.4 (4432)	59.8 (4043)	-	-	-	32.7 (2891)	26.1 (4306)	26.7 (4357)	15.2 (125)	15.5 (232)	3.9 (494)
S. aureus (all isolates)	52.8 (163)	70.5 (1376)	59.7 (288)	9.8 (674)	8.1 (494)	7.1 (1007)	-	-	-	-	-	-	2.7 (2067)	3.1 (1883)	8.2 (6179)	32.9 (10391)	29.9 (13839)	29.5 (12765)	36.8 (12036)	30.4 (18439)	31.4 (17043)	35.3 (11509)	30.5 (16945)	29.7 (15934)	-	-	-	7.2 (265)	1.4 (490)	7.1 (549)	-	-	-	7.7 (10504)	4.9 (16842)	4.8 (16246)	0.1 (10606)	0.1 (17355)	0.1 (16513)	33.9 (11984)	27.8 (19037)	30.1 (16230)	-	-	-	11.8 (11963)	8.4 (17127)	7.8 (14860)	6.4 (1667)	5.8 (1459)	1.4 (2265)
Staphylococcus aureus (MRSA)	-	-	97.1 (35)	-	-	15.3 (216)	-	-	-	-	-	-	-	-	16.7 (1655)	-	-	87.7 (3603)	-	-	90.4 (3797)	-	-	89.8 (3726)	-	-	-	-	-	42 (88)	-	-	-	-	-	13.8 (3816)	-	-	0.1 (3880)	-	-	100 (3917)	-	-	-	-	-	15.6 (3297)	-	-	2.2 (1019)
Streptococcus, beta-haem. Group A	-	-	-	-	-	-	-	-	-	-	-	-	7.5 (160)	4.3 (463)	4.3 (463)	65.8 (316)	33.1 (812)	30.9 (460)	10.2 (420)	6.5 (937)	7.2 (513)	-	-	-	-	-	-	-	-	-	46 (315)	43.7 (636)	52.4 (494)	-	-	-	-	-	-	-	-	-	5.3 (451)	0.4 (926)	0.4 (557)	-	-	-	-	-	-
Streptococcus, beta-haem. Group B	-	-	-	-	-	-	-	-	-	-	-	-	11.3 (886)	6.2 (2369)	7.7 (2693)	54.2 (2621)	34.1 (4168)	42.3 (3089)	8.1 (3146)	4.4 (4771)	6.2 (3665)	-	-	-	-	-	-	-	-	-	64.4 (2510)	61.8 (4425)	65.5 (3220)	-	-	-	-	-	-	-	-	-	2.4 (3265)	0.3 (4698)	0.4 (3589)	-	-	-	-	-	-
Enterococcus sp.	20.1 (786)	20.6 (1562)	23.1 (1449)	-	-	-	-	-	-	47.6 (370)	54 (807)	40.4 (721)	-	-	62.5 (16)	41.6 (742)	46 (1462)	42.6 (1234)	-	-	-	-	-	-	45.5 (567)	49.6 (1218)	32.3 (1332)	6.4 (375)	10.1 (744)	13.6 (685)	-	-	-	-	-	-	2.9 (886)	0.9 (1558)	1.8 (1426)	-	-	-	-	-	-	-	-	-	-	-	-
Streptococcus pneumoniae	-	-	-	-	-	-	0.5 (204)	0.9 (321)	1.5 (400)	-	-	-	-	-	-	32 (228)	31.8 (368)	34.1 (422)	21.9 (260)	19.5 (406)	21.8 (481)	-	-	-	-	-	-	-	-	-	73.7 (179)	71.5 (485)	30.8 (377)	-	-	-	0.4 (229)	0 (380)	0.2 (439)	-	-	-	13.4 (290)	11.7 (429)	15 (253)	-	-	-	-	-	-

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM POSITIVE BACTERIA 2006

Organisms	Amikacin	Amoxicillin/Clavulanic	Ampicillin	Cefepime	Cefotaxime	Ceftazidime	Ceftriaxone	Ceftizoxime sodium	Chloramphenicol	Ciprofloxacin	Clindamycin	Erythromycin	Fusidic acid	Gentamicin	Gentamicin-High	Imipenem	Methicillin	Mupirocin	Nitrofurantoin	Penicilin G	Piperacillin	Rifampin	Tetracycline	Trimethoprim/Sulfam	Vancomycin
E. feacalis	0 [1]	3.7 [27]	4 [598]						31.2 [32]	33.9 [168]				29.4 [17]	19.3 [545]	9.7 [62]			2.5 [163]	16.7 [108]			82.7 [127]	17.2 [447]	0.7 [598]
E. feacium		18.2 [11]	54.5 [145]						28.6 [14]	62.1 [58]				66.7 [6]	46.6 [131]	60.7 [28]			43.9 [57]	56.8 [44]			77.8 [45]	53.1 [81]	1.4 [145]
Enterococcus sp	7.7 [13]	25.6 [347]	20.6 [2370]	14.1 [99]	32.8 [119]	13.9 [72]	35.7 [129]	19.5 [82]	25.3 [340]	36 [1076]				27.8 [356]	27 [1949]	15.6 [167]			12 [956]	36.3 [479]			77.1 [493]	32.1 [1810]	1 [2318]
S. aureus (all isolates)	64.3 [544]		66.5 [403]			89.6 [541]	92.4 [525]	25 [8]	6.9 [508]	31 [3718]	7.3 [7202]	31.3 [17793]	6.3 [15585]	29.5 [18066]		15.4 [13]	31.5 [14826]	0.2 [4172]	7.1 [537]	84.3 [9409]		5.5 [17258]	33.3 [30]	26.7 [14760]	0.1* [17576]
S. aureus (ICU isolates)	86.5 [52]		50 [14]			98.1 [52]	100 [51]		0 [2]	51.4 [434]	2.4 [125]	44.6 [814]	7.1 [686]	43.1 [815]			41.8 [411]	1.3 [76]	10 [30]	88.6 [642]		4.1 [808]		38 [410]	0.4* [817]
S. aureus (MRSA)	66.5 [520]		96.2 [79]			93.8 [514]	93.8 [516]		15.3 [72]	72.9 [484]	17.7 [2638]	91.7 [4581]	7.3 [4084]	91.5 [4640]			100 [4669]	0.2 [1959]	31.3 [99]	99.5 [1393]		15.7 [4578]		81.5 [4610]	0.1* [4661]
Staph Coag-neg	20.2 [460]	13.8 [65]	55.1 [136]		47.6 [63]	83.5 [462]	79.6 [455]	55.2 [67]	19.4 [417]	25.9 [1562]	18.5 [2228]	49.7 [6203]	18.8 [5766]	41.7 [6614]		6.2 [64]	63.5 [5637]	0.3 [1803]	18.5 [271]	78.9 [2441]	35.9 [64]	14.1 [6210]	33.3 [6]	38.1 [5351]	0.3* [6618]
S. agalacteae											7.7 [1111]	6 [1229]								0 [1229]			56.9 [1229]	0.2 [1229]	0 [3]
S. pyogenes	0 [24]		1.2 [338]	2.9 [69]	0 [66]		0 [22]				5.3 [114]	6 [134]								0 [135]			49.6 [133]	5.2 [135]	0 [13]
Strep Gp A		16.7 [6]	1.4 [1826]	1.7 [658]	1.5 [872]	0 [5]	1.2 [84]		6.7 [178]	16.7 [12]	3.5 [735]	7.4 [863]	30 [20]	36 [242]						1.3 [893]			51.8 [811]	18.5 [816]	0 [208]
Strep Gp B			8.7 [23]	0 [29]	0 [93]	0 [12]	3.5 [634]	1.4 [504]	6.1 [1610]	12.2 [49]	7.4 [4864]	5.5 [5566]	27.3 [22]	90.1 [736]					6.6 [136]	1.9 [5662]			61.4 [5386]	18.5 [5383]	1* [1299]
S. pneumoniae						0 [6]	0 [412]		5.6 [231]	0 [6]	20 [85]	28.4 [482]		66.7 [15]						13.2 [280]			38 [413]	37.4 [479]	0 [477]
S. pneumoniae (invasive)			10 [10]	0 [11]	0 [22]	0 [3]	0 [115]		6.7 [60]	0 [1]	0 [17]	22.8 [145]		50 [2]						10.1 [79]			37.6 [133]	40.4 [146]	0 [146]
S. pneumoniae (noninvasive)			7.7 [13]	0 [18]	0 [71]	0 [3]	0 [294]		5.3 [171]	0 [5]	25 [88]	31.1 [334]		69.2 [13]						14.4 [201]			38.4 [279]	36.1 [330]	0 [329]

[ ] No. tested
* Not verified

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM POSITIVE BACTERIA 2007

Organisms	Amikacin	Amoxicillin/ Clavulanic acid	Ampicillin	Cefepime	Cefotaxime	Ceftazidime	Ceftriaxone	Cefuroxime sodium	Chloramphenicol	Ciprofloxacin	Clindamycin	Erythromycin	Fusidic acid	Gentamicin	Gentamicin-High	Imipenem	Methicillin	Nitrofurantoin	Penicillin G	Piperacillin	Rifampin	Tetracycline	Trimethoprim/ Sulfamethoxazole	Vancomycin
E. faecalis		4.5 [179]	6.3 [820]	82.4 [17]	77.3 [22]	100 [1]	68.9 [180]	83.3 [6]	32.4 [182]	26.8 [295]	97.1 [70]	55.6 [266]		35 [452]	22.1 [625]	8.5 [47]			36.7 [283]			83.5 [297]	33.9 [825]	0.4* [1011]
E. faecium		72.1 [43]	65.3 [239]	100 [7]	58.3 [12]		83.3 [36]	100 [2]	8.2 [49]	73.1 [104]	69 [29]	81.4 [70]		63.5 [115]	53.2 [190]	82.6 [23]			63.5 [85]			85.9 [99]	66.4 [211]	0 [283]
Enterococcus sp		22 [246]	26.4 [1669]	69.2 [19]	67.9 [106]	0 [8]	78.4 [97]		27.7 [231]	42.9 [999]	84 [131]	67.6 [139]		33.6 [402]	32.3 [1270]	11.1 [9]			50.8 [388]			74.7 [375]	45.9 [1303]	0.9* [1766]
S. aureus (all isolates)	78 [617]	20 [10]	68.8 [868]	24.1 [29]	50 [6]	90.1 [627]	98.2 [556]		4 [1196]	32 [3869]	8.5 [8674]	30.4 [19927]	7.4 [17163]	27.6 [19922]		30.8 [13]	28.8 [14966]	3.8 [889]	82.6 [10494]		4.2 [19531]	56 [25]	26 [17158]	0 [19875]
S. aureus (ICU isolates)	66.6 [62]		71.4 [21]			96.5 [57]	98.1 [53]		3.8 [52]	34.8 [419]	10.2 [256]	32.9 [947]	6.9 [695]	28.8 [948]			30 [952]	13 [23]	83.5 [757]		3.5 [949]		30.1 [602]	0 [955]
S. aureus (MRSA)	80.9 [589]								18.2 [137]	59.1 [580]	24.4 [2643]	95 [4261]	6.5 [3635]	93.5 [4271]				19 [126]			13.5 [4264]		89.3 [4300]	0 [4313]
Staph Coag-neg	14.8 [539]	16.7 [66]	69.6 [678]	63.6 [22]	47 [66]	88.4 [533]	93.8 [514]		14.2 [930]	14.2 [8359]	15.2 [3487]	51.4 [8397]	23.9 [7790]	38.4 [8739]		15.2 [66]		8 [785]	80.2 [4046]	53.2 [62]	14.2 [8359]	22.2 [9]	37.1 [7701]	0.3* [8855]
Group B Streptococcus		4.5 [440]	1.4 [1735]	3.1 [519]	2.5 [1248]		9.2 [9228]	2.8 [213]	7 [2145]		6.9 [6380]	5.3 [7294]		74.6 [1202]				5.7 [158]	2.3 [7361]			63.8 [7194]	27.9 [7284]	1.2 [1897]
Group A Streptococcus		0 [47]	0.7 [304]	0 [35]	2.7 [183]		1.8 [163]	11.8 [17]	8.7 [277]		3.7 [1056]	5.7 [1183]		1.9 [251]					2 [1181]			49.6 [1137]	30.4 [1164]	0.8 [241]
S. pneumoniae		0 [28]	12.5 [8]	0 [24]	0 [85]	0 [4]	0.5 [400]	0 [24]	7.3 [165]		10.4 [77]	22.8 [456]		31.6 [19]					15.1 [269]			35.1 [405]	38.7 [450]	0.2 [455]
S. pneumoniae (invasive)		0 [12]	0 [3]	0 [12]	0 [30]		0.7 [134]	0 [12]	7.7 [52]		20 [10]	21.9 [146]		20 [10]					15.5 [97]			33.1 [133]	36.1 [147]	0.7 [144]

[ ] No. tested
* Not verified

Appendix 10 (i)

COMMON ISOLATES FROM INTENSIVE CARE UNIT (ICU)
2006

Organism	HSAJB	HKL	HKL+PAEDS	HKT	HPP	HTF	HSEL	HMLK	HTAA	HSB	All Hospital
Staphylococcus aureus	14.2 [407]	15.6 [333]	16.1 [361]	10.5 [30]	15.8 [109]	7.6 [13]	10.8 [59]	10.7 [124]	14.7 [66]	17.5 [48]	14.2 [1550]
Pseudomonas aeruginosa	12.8 [366]	11.6 [249]	16.4 [367]	10.1 [29]	16.6 [115]	19.4 [33]	10.5 [57]	12.8 [148]	17.4 [78]	17.5 [48]	13.6 [1490]
Klebsiella pneumoniae	20 [573]			15.4 [44]	9.2 [64]	15.2 [26]	18.6 [101]	21.8 [252]	10.5 [47]	12.7 [35]	10.5 [1142]
Coag-negative Staph (SCN)	0.5 [143]	14.6 [313]	13.5 [301]	8.4 [24]	15.5 [107]		16.2 [88]	4.3 [49]	10.7 [48]		9.8 [1073]
Acinetobacter sp.	0.4 [11]	11.6 [249]	13.2 [296]	0.7 [2]	10.5 [73]	7.6 [13]	14 [76]	5 [58]	1.8 [8]	18.2 [50]	7.7 [836]
A. baumannii (anitratus)	13.4 [384]			22.7 [65]				10 [116]	17 [76]		6 [656]
Escherichia coli	4.2 [120]	7.6 [162]	[72]	3.8 [11]	4.3 [30]	eco [9]	5.4 [29]	4.5 [52]	3.8 [17]	4 [11]	4.6 [513]
Candida sp.	10.8 [308]	2.6 [56]	2.8 [63]	2.4 [7]		2.9 [5]			0.6 [3]		4 [442]
Klebsiella sp.		9.6 [206]	9.9 [222]	2.4 [7]	0.1 [1]		0.4 [2]		0.2 [1]		4 [439]
Enterobacter sp.	4.1 [116]	4 [86]	3.4 [76]	1.7 [5]	2.9 [20]	3.5 [6]	5.2 [28]	3.2 [37]	2.5 [11]	4.4 [12]	3.6 [397]
Candida albicans	1.5 [42]	4.5 [97]	4.4 [98]	3.1 [9]		5.3 [9]					2.3 [255]
Total Isolates	2863	2141	2237	286	692	170	542	1152	448	274	10916

[ ] No. isolated

HPP - Hospital Pulau Pinang
HKL - Hospital Kuala Lumpur
HSAJB - Hospital Sultanah Aminah
HSNZ - Hospital Sultanah Nur Zahirah
HMEL - Hospital Melaka
HTAA- Hospital Tengku Ampuan Afzan
HTAR - Hospital Tuanku Rahimah
HTF - Hospital Tuanku Fauziah
HIPH - Hospital Ipoh
HTJ - Hospital Tuanku Jaafar
HSB - Hospital Sultanah Bahiyah
HSEL - Hospital Selayan

Appendix 10 (ii)

COMMON ISOLATES FROM INTENSIVE CARE UNIT (ICU)
2007

Organism	HSAJB	HKL	HSNZ	HPP	HKGR	HSEL	HMEL	HTAA	HSB	HIPH	HTJ	All Hospital
Staphylococcus aureus	12 [362]	18 [133]	11 [54]	15 [65]	8 [20]	15 [33]	17 [254]	13 [27]	15 [53]	8 [3]	11 [52]	14 [1056]
Pseudomonas aeruginosa	12 [366]	25 [188]	14 [72]	21 [93]	20 [54]	12 [26]	11 [161]	14 [28]	11 [37]	3 [1]	10 [50]	19 [1076]
Klebsiella pneumoniae	21 [654]	14 [103]	14 [70]	11 [48]	6 [16]	15 [34]	19 [285]	11 [22]	14 [49]	8 [3]	9 [43]	18 [1327]
Coag-negative Staph	6 [173]	5 [36]	17 [87]	10 [45]	15 [41]	17 [39]	6 [91]	18 [38]	9 [30]	11 [4]	12 [57]	10 [641]
Acinetobacter sp.	14 [441]	14 [100]	15 [78]	18 [80]	11 [29]	14 [31]	13 [198]	10 [20]	19 [67]	32 [12]	13 [66]	15 [1122]
Escherichia coli	4 [139]	2 [18]	5 [26]	4 [17]	7 [19]	7 [15]	6 [93]	5 [11]	5 [18]	11 [4]	4 [20]	4 [380]
Candida albicans	2 [47]	2 [14]	2 [10]		2 [6]		3 [40]			3 [1]	2 [12]	1.5 [130]
Candida sp.	9 [274]	3 [21]	3 [14]		3 [7]		2 [26]			8 [3]	2 [12]	7 [357]
Enterobacter sp.	4 [126]	4 [33]	2 [10]	4.4 [20]	0.7 [2]	2 [5]	2.6 [39]	3 [6]	3 [11]	8 [3]	2 [9]	3 [264]
Total Isolates	2582	646	421	368	194	183	1187	152	265	34	321	6353

[ ] No. isolated

HPP - Hospital Pulau Pinang
HKL - Hospital Kuala Lumpur
HSAJB - Hospital Sultanah Aminah
HSNZ - Hospital Sultanah Nur Zahirah
HMEL - Hospital Melaka
HTAA- Hospital Tengku Ampuan Afzan
HTAR - Hospital Tuanku Rahimah
HTF - Hospital Tuanku Fauziah
HIPH - Hospital Ipoh
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HSB - Hospital Sultanah Bahiyah
HSEL - Hospital Selayang

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