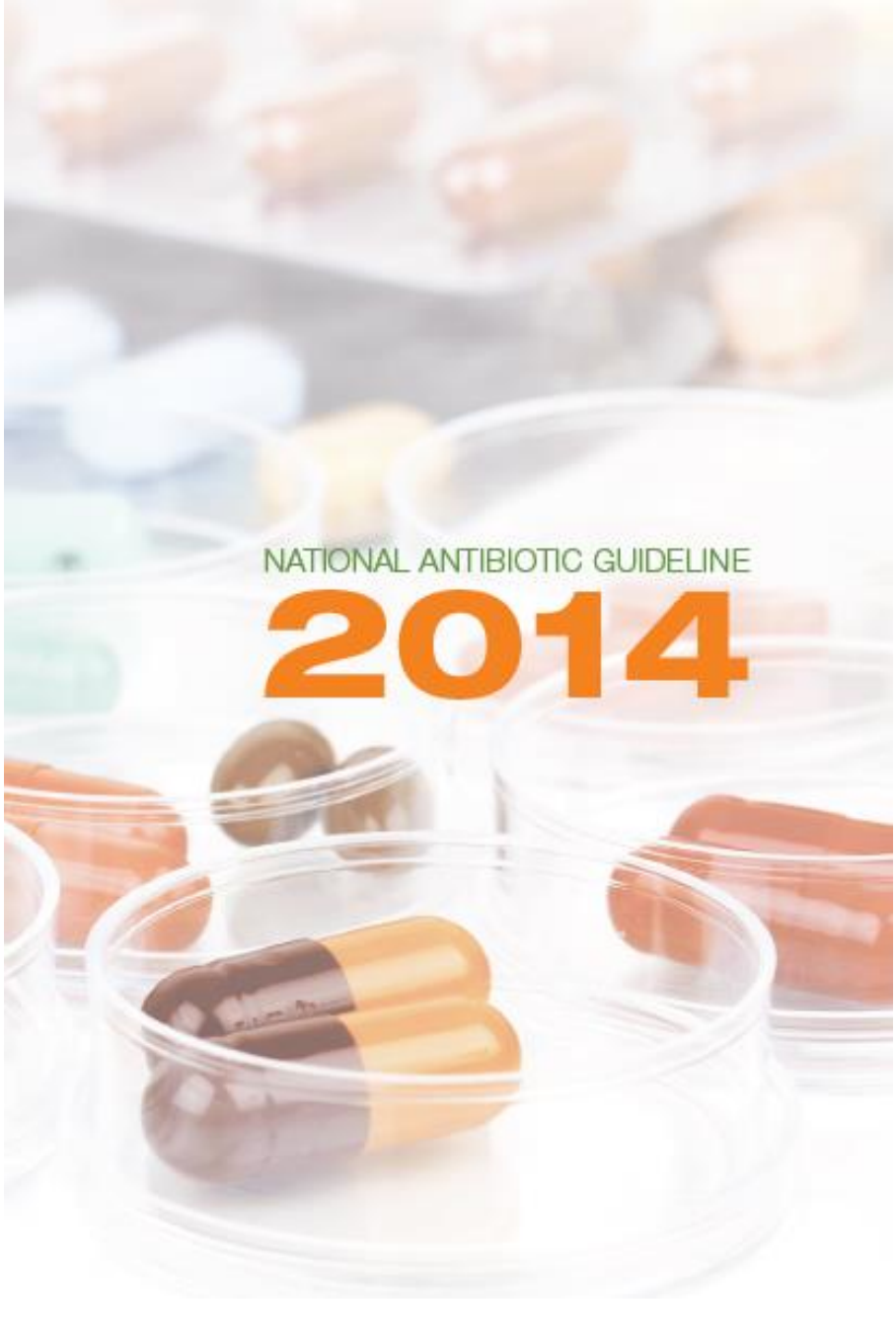
NATIONAL ANTIBIOTIC GUIDELINE
2014

NATIONAL ANTIBIOTIC GUIDELINE

2014

SECOND EDITION
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This guideline is constantly being reviewed and will be updated periodically via website or app

Produced & Distributed by :
PHARMACEUTICAL SERVICES DIVISION
MINISTRY OF HEALTH MALAYSIA
LOT 36, JALAN UNIVERSITI
46350 PETALING JAYA
SELANGOR , MALAYSIA

TEL : 603-78413200
FAX : 603-79682222
WEBSITE : www.pharmacy.gov.my

MESSAGE FROM THE DIRECTOR GENERAL OF HEALTH MALAYSIA

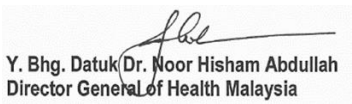
The first edition of National Antibiotic Guideline was launched in 2008 with its primary aim to guide clinicians in the Ministry of Health in their empirical choice of antimicrobial agents. Nevertheless, local sensitivity patterns should also be taken into consideration where necessary.

This guide is important to enhance appropriate prescribing of antimicrobials to avoid dubious indication and inappropriate duration. Even though treatment with antimicrobial agents has contributed to the reduction of infectious disease, there is still a concern for the development of antimicrobial resistance due to inappropriate use of antimicrobial. The emergence of antimicrobial resistance will require the antimicrobial to be used appropriately and effectively.

2nd Edition of National Antibiotic Guideline 2014 is in line with the Protocol on Antimicrobial Stewardship (AMS) Program in Healthcare Facilities, which was launched in 2014. Implementation of AMS program will use this guideline as reference for audit purposes. Both guidelines will hopefully benefit the clinicians and pharmacists in advocating good prescribing practice of antimicrobial and subsequently can curb antimicrobial resistance and minimize healthcare cost.

I would like to congratulate all committee members, from various department, headed by Datuk Dr. Christopher Lee, for their great collaborative effort in revising and updating the first edition of National Antibiotic Guideline and thus, have come up with the 2nd edition with latest available evidence as possible. This collaborative effort is a reflection of great team work among officers in the Ministry of Health.

Certainly, this is not an easy job; all the effort that was put in to produce this guideline should be appreciated. I strongly urge everyone in the Ministry of Health to make full use of this guideline as reference in their routine work. However, it is important to note that this guideline does not replace the need for consultation for expert advice and should always be tailored to each individual needs.



Y. Bhg. Datuk Dr. Noor Hisham Abdullah
Director General of Health Malaysia

WORKING COMMITTEES

Infectious Disease Physicians:

Dr. Suresh Kumar
Sg. Buloh Hospital

Dr. Thahira Jamal
Kuala Lumpur Hospital

Dr. Suraya Hanim
Sg. Buloh Hospital

Dr. Rosnida Mohd Noh
Sg. Buloh Hospital

Dr. Yasmin Abdul Ghani
Sg. Buloh Hospital

Dr. Anusha Shunmugarajoo
Raja Permaisuri Bainun Hospital

Dr. Cheng Joo Thye
Raja Permaisuri Bainun Hospital

Dr. Leong Kar Nim
Pulau Pinang Hospital

Dr. Lee Heng Ghee
Queen Elizabeth I Hospital

Dr. Dzawani Muhamad
Sg. Buloh Hospital

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Hospital Selayang

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Kuala Lumpur Hospital

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Kuala Lumpur Hospital

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Kuala Lumpur Hospital

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Kuala Lumpur Hospital

Ms. Goh Chia Mein
Kuala Lumpur Hospital

Ms. Lee Mei Wah
Kuala Lumpur Hospital

TDM Committee

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Institute for Medical Research

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Sg. Buloh Hospital

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Sg. Buloh Hospital

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Sg. Buloh Hospital

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Putrajaya Hospital

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National Cancer Institute

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Selayang Hospital

Dr. Azizah Mustafa
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Serdang Hospital

Dr. Nurzam Suhaila
Kuala Lumpur Hospital

Dr. Sahlawati Mustakim
Tengku Ampuan Rahimah Hospital

Dr. Hazilawati Hussin
Ampang Hospital

CONTRIBUTORS

A. SURGERY
Dato' Dr. Jamil Abdullah
Dato' Dr. Mohamed Yusof
Dato' Zakaria Zahari
Mr. Zainal Ariffin Azizi
Dato' Dr. Lim Lay Hooi
Mr. Rohan Malek Johan Thambu
Mr. Krishnan a/l Raman
Dr. Rica Farah
Mr. Johari Siregar Adnan

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Dr. Fong Siew Moy
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Dr. Thahira Jamal
Dr. Choo Chong Ming

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Dr. Siti Nor Roha Daman Huri
Dr. Jamalia Rahmat
Dr. Shelina Oli Mohamed
Dr. Norlaila Talib

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Dr. Tai Li Ling

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Dr. Sabeera Begum
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Dr. Tang Jyh Jong
Ms. Azura Kasim

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Dato' Dr. Tan Chwee Choon
Dr. Wong Hin Seng

G. NEUROLOGY
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H. GASTOINTESTINAL
Dato' Dr. Muhammad Radzi
Dato' Dr. Wan Khamizar Wan Khazim

I. ORAL HEALTH
Dr. Sivakama Sunthari
Dr. Sherrie Chong Mei Yee
Dr. Sharifah Tahirah
Dr. Renukanth Raman

J. TROPICAL INFECTIONS
Dr. Suresh Kumar
Ms. Anitha Ramadas

K. OBSTETRIC & GYNAECOLOGY
Dr. J. Ravichandran
Dr. Vairavan@Ramesh

L. RESPIRATORY
Dr. Ashari Yunus
Mr. Fariz Ariffin

M. OTORHINOLARINGOLOGY
Dr. Melati Hj Abdul Ghani
Dato' Dr. Majid Md. Nasir
Datin Dr Siti Sabzah Mohd Hashim
Dr Zulkiflee Salahuddin
Dato' Dr. Narizan Ariffin
Dr. Norleza Ahmad Norhan
Mr. Tan Chee Chin

N. CARDIOVASCULAR INFECTIONS
Dato' Dr. Omar Ismail
Dato' Dr. Mohd Hamzah

O. INFECTIONS INIMMUNOCOMPROMISED PATIENTS
Dato' Dr. Chang Kian Meng
Dr. Chew Lee Ping
Prof. Dr. Gan Gin Gin
Prof. Dr. Fadilah
Dr. Goh Kim Yean
Dr. Chew Teng Keat
Dr. Chua Hock Hin
Dr. Suresh Kumar
Dr. Benedict Sim
Dr. Norkasihan Ibrahim

P. ORTHOPEADIC
Dato' Dr. N. Premchandran
Dato' Dr. Zulkiflee Osman
Dr. Tajuddin
Dr. Chye

EXTERNAL REVIEWERS

Prof. Dr. Adeeba Kamarulzaman
University Malaya Medical Centre

Prof. Madya Dr. Sasheela Vanar
University Malaya Medical Centre

Prof. Dr. Zamberi Sekawi
University Putra Malaysia

Dr. Petrick Periyasamy
National University of Malaysia Hospital

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Appendices

ABBREVIATIONS AND ACRONYMS

ABLC : Amphotericin B lipid complex
ABW : Actual Body Weight
ACT : Artemisinin-based Combination Therapy
AMS : Antimicrobial Stewardship
ANC : Absolute Neutrophil Count
APACHE : Acute Physiology and Chronic Health Evaluation
ASA : Aspirin
ASMQ : Artesunate and Mefloquine
ASP : Antimicrobial Stewardship Program
AVF : Arteriovenous Fistula
BI : Bacteriological Index
BMI : Body Mass Index
C&S : culture & sensitivity
CAP : Community-Acquired Pneumonia
CAPD : Continuous Ambulatory Peritoneal Dialysis
CDC : Centers for Disease Control and Prevention
CF : Cystic fibrosis
ClCr : Creatinine Clearance
cm : centimetre
CMC : Chloramphenicol
CMV : *Cytomegalovirus*
CNS : Central Nervous System
COAD : Chronic Obstructive Airways Disease
COPD : Chronic Obstructive Pulmonary Disease
CRE : Carbapenem Resistant Enterobactericae
CRP : C-reactive Protein
CSF : Cerebrospinal Fluid
CT SCAN : Computed Tomography Scan
CVVH : Continuous Veno-Venous Hemofiltration
CVVHD : Continuous venovenous hemodialysis
CVVHDF : Continuous VenoVenous HemoDiaFiltration
CXR : Chest X-ray
DG : Director General of Health
EIA : Enzyme Immunoassay
EID : Extended- Interval Therapy
ENT : Ear, Nose, Throat
EPTB : Extrapulmonary tuberculosis
ERCP : Endoscopic Retrograde Cholangiopancreatogram
ESBL : Extended-spectrum beta-lactamases
ESC : European Society of Cardiology
ESRD : End-stage Kidney Disease
EVAR : Endovascular Aneurysm Repair
FBC : Full Blood Count
FEME : Full Examination, Microscopic Examination
FEV1 : Forced Expiratory Volume in 1 second
G6PD : Glucose-6-phosphate Dehydrogenase
GBS : Group B Streptococcal
GFR : Glomerular Filtration Rate
GIT : Gastrointestinal Tract
gm : gram
GNB : gram negative bacilli
HAART : Highly Active Antiretroviral Therapy
HAP : Hospital-Acquired Pneumonia
HCAP : Health-care Associated Pneumonia
HCL : Hydrochloride
HD : Hemodialysis
HIV : *Human Immunodeficiency Virus*
HIV-TB : H*uman Immunodeficiency Virus*-Tuberculosis
HSV : Herpes Simplex Virus
IBW : Ideal Body Weight
ICU : Intensive Care Unit
IDSA : Infectious Diseases Society of America
IE : Infective Endocarditis
IFA : Indirect Fluorescent Antibody
IM : Intramuscular Administration
IV : Intravenous Administration
IVDU : Intravenous Drug User
kg : kilogram
LP : Lumbar Punctures
LRTI : Lower Respiratory Tract Infections
MCUG : Micturating Cystourethogram
MDR : Multidrug-resistant
MDR-TB : Multidrug-resistant Tuberculosis
MIC : Minimum Inhibitory Concentration
MOH : Ministry of Health
MRSA : Methicillin-resistant Staphylococcus aureus
MSSA : Methicillin-sensitive Staphylococcus aureus
MU : Mega Units
NAAT : Nucleic Acid Amplification Test
NSAID : Non-Steroidal Anti-Inflammatory Drugs
NSU : Non-Specific Urethritis
ORL : Othorhinolaryngology
ORS : Oral Rehydration Salts
PCNL : Percutaneous Nephrolithotomy
PCR : Polymerase Chain Reaction
PD : Peritoneal Dialysis
PI : Protease inhibitors
PO : (*per os*) oral administration
PPI : Proton Pump Inhibitors

PSD : Pharmaceutical Services Division
PTB : Pulmonary Tuberculosis
PUD : Peptic Ulcer Disease
q12h : every 12 hours
q24h : every 24 hours
q6h : every 6 hours
q8h : every 8 hours
RCMM : Robertson's Cook Meat Medium
RIRS : Retrograde Intrarenal Surgery
SBE : Subacute Bacterial Endocarditis
SDD : Single Daily Dosing
SGC : Soft Gel Capsule
SIRS : Systemic Inflammatory Response Syndrome
sp. : species
spp. : species
SSG : Split skin grafting
STD : Sexually Transmitted Diseases
TAHBSO : Total Abdominal Hysterectomy Bilateral Saphingo-Oophorectomy
TB : Tuberculosis
TDM : Therapeutic Drug Monitoring
TEVAR: Thoracic Endovascular Aneurysm Repair
TIG : Tetanus Immune Globulin
TMP-SMX : Trimethoprim/ sulfamethoxazole
TURP : Trans-Urethral Resection of the Prostate
URS : Uretero-Renoscopy
UTI : Urinary Tract Infection
VAP : Ventilator-associated pneumonia
VDRL : Venereal Disease Research Laboratory
VRE : Vancomycin Resistant Enterococus
WHO : World Health Organization
yr : year

INTRODUCTION TO THE GUIDELINES

It is now well recognized that antibiotics have been one of the major medical advances in the last century; having saved millions of lives since the discovery of penicillin in the 1940s. Antibiotics have transformed the practice and outlook of modern medicine, allowing once fatal infections readily treatable and making other medical advances, like cancer chemotherapy and organ transplantations, possible. Unfortunately, this major breakthrough of modern medicine was followed by the phenomenon of resistance. Antibiotic resistance has raged on with relentless speed so much so that in 2011, the World Health Organization (WHO) declared it a global health threat. This phenomenon has been driven mainly by the use and misuse of antibiotics. It is estimated that 20-50% of all antibiotics prescribed in U.S. acute care hospitals are either unnecessary or inappropriate. Unlike other medications, the potential for spread of resistant organisms means that the misuse of antibiotics can adversely impact the health of patients who are not even exposed to them. Hence, the inadequate level of infection control can act as an amplifier of antibiotic resistance.

Improving the use of antibiotics is now an important patient safety and public health issue as well as a national and global priority. The use of antibiotics needs to be improved not just to improve clinical outcomes and decrease healthcare expenditures but also to reverse or slow down resistance. Antibiotic guidelines have always played a major role in providing guidance to healthcare personnel in the management of infections. This is especially important when one has to take into account the ever changing antimicrobial resistance that is evolving with time and medical practice. Hence, the National Infection and Antimicrobial Control Committee (NIACC) of the Ministry of Health have taken the task to update our national guidelines which was last compiled in 2008.

The editorial team has taken into account, the changes in antimicrobial resistance patterns seen in various sectors of clinical practice, the trends in antimicrobial utilization as well as current guidelines and new clinical data, in formulating this current edition of the guidelines. While, we have tried to be as evidence-based as possible, we did have to take cognizance of logistic issues eg. cost and drug availability as well as pragmatic issues of current local practices.

As in the previous edition, the compilation of the 2014 Antibiotic Guidelines involved a broad spectrum of specialists, microbiologists and pharmacists. I would like to convey my heartfelt gratitude to the core editorial team which comprised of a dedicated team of infectious diseases physicians, pharmacists and medical microbiologists; without whom, this document would not have come to fruition. I would particularly like to thank Puan Rosminah binti Mohd Din and her team from the Pharmacy Division for their patience, perseverance and commitment in collating and producing this very important document. A special word of thanks also goes out to the Director General of Health, Datuk Dr Noor Hisham bin Abdullah as well as our external reviewers for their advice and input. I hope our clinicians will find the guidelines useful in their daily practice as well as, help all of us achieve our collective goal and responsibility of curtailing antimicrobial resistance in this country.

DATUK DR CHRISTOPHER KC LEE
National Advisor for Infectious Diseases
Head & Senior Consultant Physician
Department of Medicine
Hospital Sungai Buloh

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.

References:

1. Dellit TH,Owens RC,McGowan JE, Gerding GN,Weinstein RA,Burke JP,Huskins WC, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for developing an institutional program to enhance antimicrobial ste ardship. Clin Infect Dis 2007; 44: 159-77.
2. Slama TG, Amin A, Brunton SA, File TM, Milkovich G, Rodvold KA, Sahm DF et al. A clinician's guide to the appropriate and accurate use of antibiotics: the Council for Appropriate and Rational Antibiotic Therapy (CARAT) criteria. Am J Med 2005; 118(7A):1S-6S
3. Ball P, Baquero F, Cars O, File T, Garau J, Klugman K, Low DE et al. Antibiotic Therapy of community respiratory tract infections: strategies for optimal outcomes and minimized resistance emergence. J Antimicrob Chemother 2002; 49:31-40
4. Gonzales R, Bartlett JG, Besser RE, Cooper RJ, Hickner JMHoffman JR, Sande MA.Principles of appriopriate antibiotic use for treatment of acute respiratory tract infections in adults: background, specific aims, and methods. Ann Intern Med 2001; 134:479-486
5. Pong AL, Bradley JS. Guidelines for the selection of antibacterial therapy in children. Pediatr Clin N Am 2005; 869-89

ANTIMICROBIAL STEWARDSHIP

The introduction of antimicrobial agents has contributed to the reduction of infectious diseases as the major cause of premature death. Treatment with antimicrobial agents seems so effective and safe that they are sometimes prescribed for dubious indications and for longer than necessary, with little concern for adverse effects and the development of resistance.

In the last 40 years, the prevalence of multidrug-resistant microorganisms (eg. extended spectrum β-lactamase inhibitor *enterobacteriaceae*) have risen alarmingly. Antimicrobial resistance (AMR) occurs when microorganisms change in ways that render the medications used to cure the infections they cause ineffective. There is evidence that overall rates of antimicrobial resistance correlate with the use of antimicrobials. Certain antimicrobials like quinolones promote the emergence of resistance more than others. Quinolone usage has been linked to an increase in *Methicillin-Resistant Staphylococcus aureus* and with increased quinolones resistance in gram negative *bacilli*.

The emergence of AMR can cause the resistance to first-line medicines and leads to the use of second or third-line drugs which is less effective, more toxic and more costly. The pace of antimicrobial development has slowed markedly in the past 20 years. As more resistance is acquired, we are eventually left without any effective drug therapies. Thus AMR can give a negative impact on patient outcomes, poses a major threat for patient safety, increases health expenditure and results in loss of treatment options for common infections.

Antimicrobial management or stewardship program have been developed as a response to these issues. Antimicrobial Stewardship (AMS) is thus a coordinated systematic approach to improve the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen; right choice of antimicrobial, right route of administration, right dose, right time, right duration and minimize harm to the patient and future patients.

The development of antimicrobial resistance strains in hospitals is intensified because of high level of antimicrobial use and concentration of patients with multiple pathogens. Ongoing monitoring and prospective audits have been shown to improve patient care, decrease unnecessary antimicrobial use and microbial resistance and reduce pharmacy expenditures. Antimicrobial Stewardship (AMS) have demonstrated 22% - 36% decrease in antimicrobial use.
(Reference : Introduction- Protocol on Antimicrobial Stewardship Program in Healthcare Facilities, MOH 2014)

ANTIBIOTIC RESISTANCE

PERCENTAGE OF ANTIBIOTIC RESISTANCE AMONG GRAM POSITIVE BACTERIA

GRAM POSITIVE ORGANISMS

A. Staphylococcus aureus

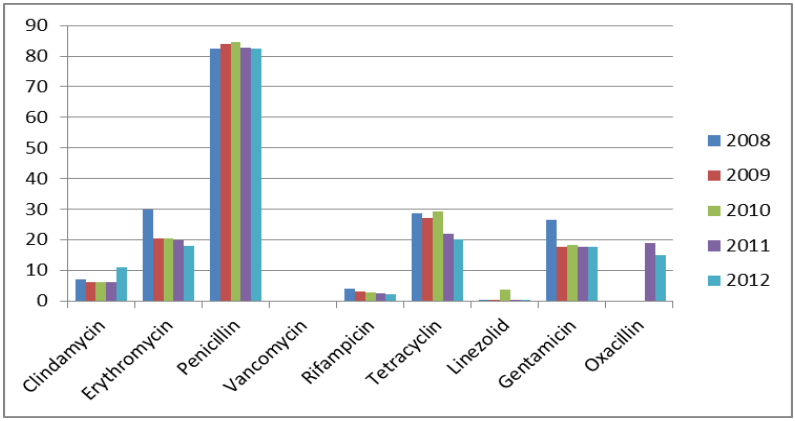


Chart 1: 5 year trend of antimicrobial resistance for *Staphylococcus aureus* against selective antibiotics (2008-2012)

Table 1: Percentage of methicillin-susceptible *S. aureus* resistant to commonly used antibiotics.

Antibiotic	MSSA [no.tested]		
	2011	2012	2013
Erythromycin	5.2 [16195]	5.1 [14307]	5.2 [16992]
Gentamicin	3.6 [16290]	2.7 [13304]	2.7 [16280]
Co-trimoxazole	2.1 [15202]	1.4 [18662]	1.2 [14352]
Rifampicin	0.7 [14752]	0.8 [12500]	0.6 [15462]
Fusidic acid	12.1 [15384]	12.7 [12509]	13.2 [13891]
Clindamycin	2.3 [13434]	2.9 [12222]	2.6 [14767]
Linezolid	0.1 [4914]	0.1 [5116]	3.7 [2240]

- There is no much difference in the resistance rate for penicillin and erythromycin for the past 3 years
- Similar pattern was noted with other drugs such as rifampicin and clindamycin
- A total of 32,611 *Staphylococcus aureus* were isolated in 2012 compared to 31,026 in 2012
- 17% of *S. aureus* was isolated from blood in 2012, compared to 16.8% in 2011.

MRSA

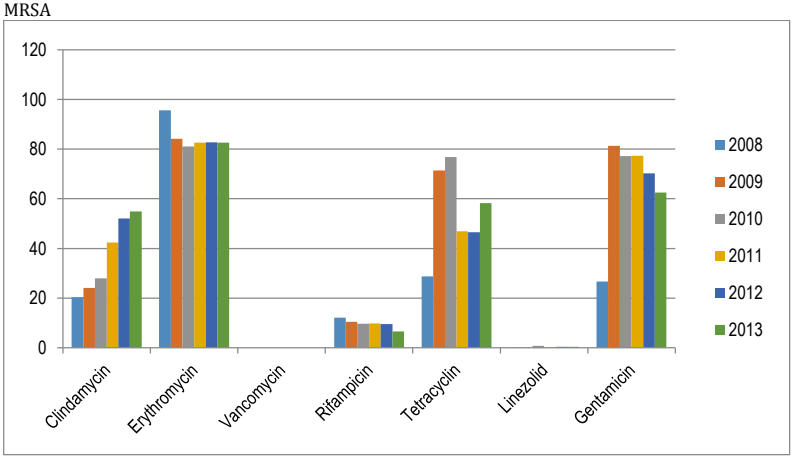


Chart 2: 6 year trend of antimicrobial resistance for MRSA against selective antibiotics (2008-2013)

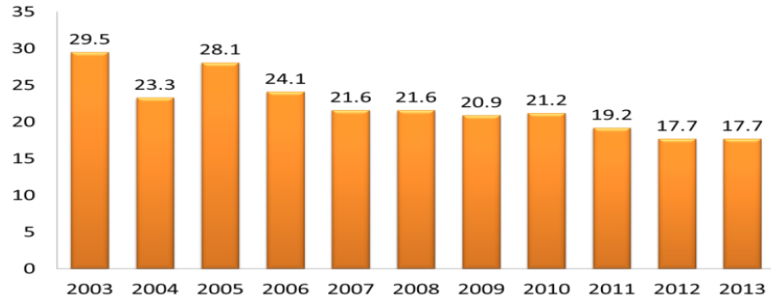


Chart 3 : MRSA rates in hospital in Malaysia

Table 2: Percentage of MRSA resistant to commonly used antibiotics

Antibiotic	MRSA [no.tested]		
	2011	2012	2013
Erythromycin	82.6 [4058]	82.7 [2751]	82.6 [4058]
Gentamicin	77.3 [4087]	70.2 [2519]	62.5 [3109]
Co-trimoxazole	74.3 [3863]	65.4 [2560]	59.6 [3003]
Rifampicin	9.8 [3874]	9.5 [2562]	6.6 [3178]
Fusidic acid	14 [3831]	14.8 [2494]	12.3 [2828]
Clindamycin	42.4 [3401]	52.1 [2313]]	54.9[3155]
Ciprofloxacin	83.1 [183]	84.1 [189]	68.2[396]

Linezolid	0.2 [1930]	0.4 [1329]	0.3 [1934]

- The rate of MRSA in hospitals varied from 2.3% to 25.8%.
- The overall MRSA in 37 Malaysian hospitals was 17.3%.
- No vancomycin-resistant *S. aureus* (VRSA) was reported till 2013.

B. Coagulase-negative *Staphylococcus* sp.

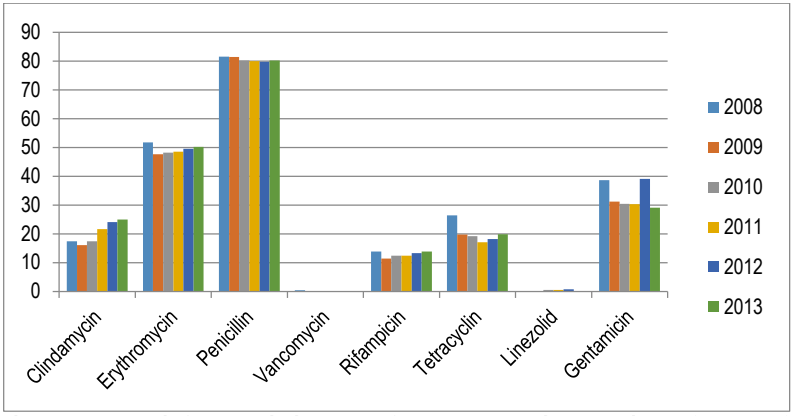


Chart 4: 6 year trend of antimicrobial resistance for CONS against selective antibiotics (2008-2013)

Table 3: Percentage of Coagulase-negative *Staphylococcus* sp resistant to commonly used antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Gentamicin	30.3 [14960]	29.5 [19894]	29.1 [19363]
Erythromycin	48.2 [14646]	49.5 [20089]	50.2[19780]
Rifampicin	12.4 [14158]	13.3 [18962]	13.9 [18962]
Fusidic acid	37.2 [13653]	39.1 [17474]	40.0 [17454]
Oxacillin	50.9 [8650]	45.8 [11089]	50.8 [12453]
Co-trimoxazole	30.5 [11974]	29.3 [17795]	28.0 [17219]
Clindamycin	21.6 [10910]	24.1 [17140]	25[17905]

- Increase resistance rates for erythromycin, clindamycin, fusidic acid, penicillin (represented by oxacillin) were observed in 2013 compared to 2012.

C. *Streptococcus pneumonia*

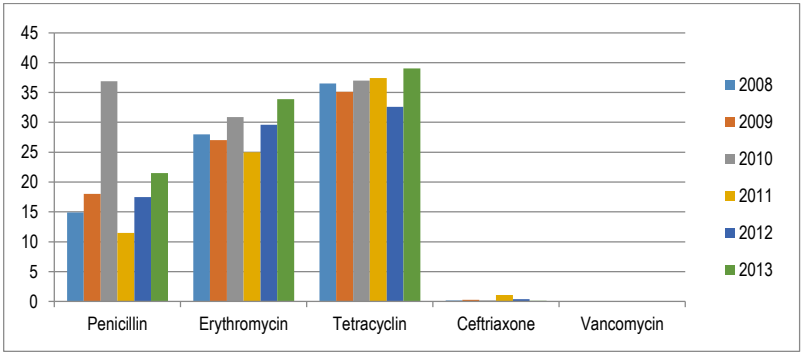


Chart 5: 6 year trend of antimicrobial resistance for Streptococcus *pneumoniae* against selective antibiotics (2008-2013)

Table 4: Percentage of *Streptococcus pneumoniae* resistant to antibiotics

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Erythromycin	25 [1363]	29.6 [1402]	33.9[1411]
Tetracycline	37.4 [1059]	32.6 [1069]	39.0 [1036]
Co-trimoxazole	33.5 [1253]	35.5 [1294]	35.5 [1271]
Chloramphenicol	15.7 [248]	8.1 [273]	12[349]
Clindamycin	16.2 [179]	18.6 [220]	20[185]
Vancomycin	0 [1312]	0 [1329]	0 [1332]

- A total of 1463 *Streptococcus pneumoniae* isolates were recorded.
- Out of these, 511 (34.9%) isolates were from blood and 25 (1.7%) from CSF.
- From 80 *S.pneumoniae* that were non-susceptible to penicillin by disc susceptibility testing, 2.5% had Penicillin minimum inhibitory concentration of > 8 µg/ml

D. Other *Streptococcus* spp.

- For Group A beta-hemolytic *streptococcus*, resistance to erythromycin is less in 2013 (5.4%) compared to 2012 and 2011.
- Clindamycin resistance has increased slightly in 2013.
- Resistance to tetracycline has increased from 51.2% in 2011 to 55.6% in 2012 and 58.4 in 2013 (Table 5).

Table 5: Percentage of Group A beta-hemolytic *streptococci* resistant to commonly used antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Erythromycin	6.9 [2637]	5.7 [2784]	5.4[2952]
Clindamycin	3.8 [2205]	3.9 [2703]	4.4[2871]
Tetracycline	51.2 [1981]	55.6 [2376]	58.4[2221]
Co-trimoxazole	51.3 [2036]	44.7 [1898]	42.9[1670]
Ceftriaxone	0.6 [702]	0.1 [785]	0[906]

- For Group B *Streptococcus*, resistance to clindamycin, tetracycline and co-trimoxazole have increased in 2013 compared to 2011 and 2012.
- Resistance to ceftriaxone has shown a decreasing trend, 1.7% in 2012 compared to 1.3% in 2013 from a much higher level in 2011 (Table 6).

Table 6: Percentage of Group B *Streptococcus* resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Erythromycin	5.7 [13439]	6.7 [16939]	6.3[18044]
Clindamycin	5.3 [12173]	6 [16324]	7.4[17684]
Tetracycline	64.3 [11058]	65 [13504]	69.4[13451]
Co-trimoxazole	53.1 [9739]	59.2 [10876]	60.2[8308]
Ceftriaxone	3.2 [3939]	1.7 [6801]	1.3[8308]

E. *Enterococcus faecium*.

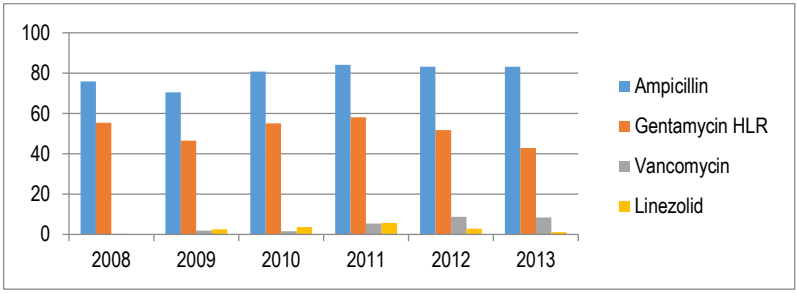


Chart 6: 6 year trend of antimicrobial resistance for *Enterococcus faecium* against selective antibiotics (2008-2013)

Table 7: Percentage of *Enterococcus faecium* resistant to antibiotics

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]

Ampicillin	84.2 [588]	83.2 [596]	83.3[653]
Ciprofloxacin	86.8 [258]	90.5 [90.5]	84.8 [224]
Gentamicin HLR	58.1[258]	51.8[330]	42.9[382]
Linezolid	5.8 [243]	2.9 [349]	1.1 [540]
Vancomycin	5.4 [595]	8.7 [606]	8.4 [667]

- The vancomycin resistance rate for *Enterococcus faecium* has increased to 8.4% in 2013 compared to 5.4%. in 2011.

F. Enterococcus faecalis.

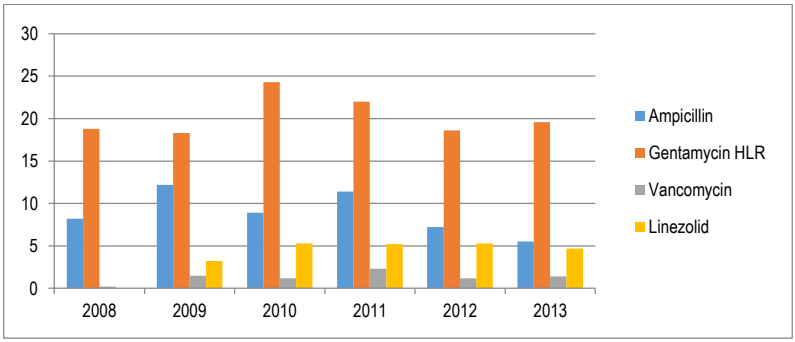


Chart 7: 6 year trend of antimicrobial resistance for *Enterococcus faecalis* against selective antibiotics (2008-2013)

Table 8: Percentage of *Enterococcus faecalis* resistant to antibiotics

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Ampicillin	11.4 [1444]	7.2 [1346]	5.5[1356]
Ciprofloxacin	29.4 [463]	20.6 [248]	21.1[437]
Gentamicin HLR	22[713]	18.6[858]	19.6[764]
Linezolid	5.2 [699]	5.3 [835]	4.7 [1029]
Vancomycin	2.3 [1472]	1.2 [1357]	1.4 [1359]

- For *Enterococcus faecalis*, the vancomycin resistance rate has reduced from 2.3% in 2011 to 1.2% in 2012 but later demonstrated a slight increase to 1.4 in 2013 (Table 8).

GRAM-NEGATIVE ORGANISMS

A. Acinetobacter sp.

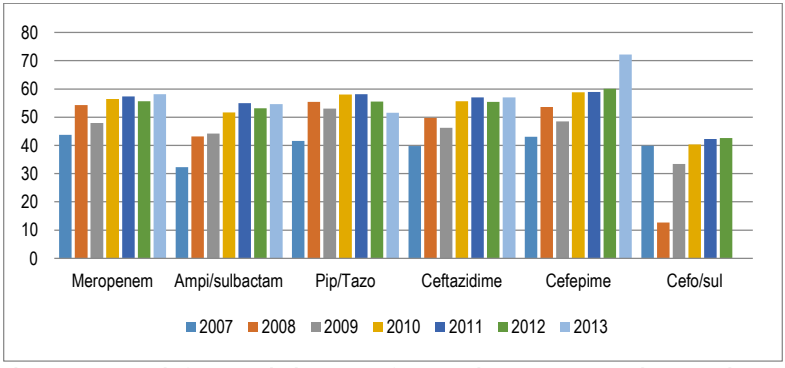


Chart 8: 6 year trend of antimicrobial resistance for Acinetobacter sp. against selective antibiotics (2007-2013)

Table 9: Percentage of *Acinetobacter* sp. resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Imipenem	56.6 [15974]	54.9 [15837]	57.1[16092]
Meropenem	57.4 [15711]	55.7 [15555]	58.3[15443]
Ampicillin/sulbactam	55 [15813]	53.2 [14996]	54.6[15202]
Piperacilin/ tazobactam	58.2 [14545]	55.5 [14358]	51.6[14500]
Ceftazidime	57 [16196]	55.4 [16015]	57.0[16033]
Cefepime	59 [7236]	60.1 [7035]	72.2[7261]
Amikacin	49.9 [16106]	45.8 [15892]	46.1[15981]
Cefoperazone	42.3 [14883]	42.6 [13119]	41[13346]
Ciprofloxacin	54.8 [15532]	52.9 [15560]	55.1[15916]
Gentamicin	53.4 [16005]	50.1 [15507]	51.2[15237]
Trimethoprim/sulphamethoxazole	47.8 [3882]	40.2 [6431]	38.4[6714]

- Resistance to polymixin B was 4.1% in 2012 compared to 1.5% in 2011 (by disc susceptibility testing).
- 9.4% of 7266 *Acinetobacter baumanii* strains were resistant to all the listed antibiotics above (excluding trimethoprim/sulfamethoxazole).

B. Escherichia coli

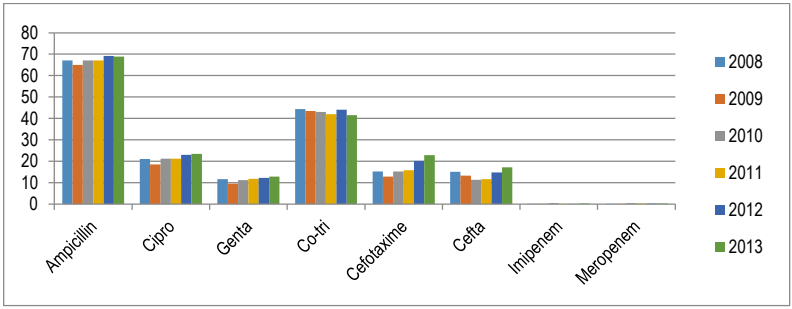


Chart 9: 6 year trend of antimicrobial resistance for *E.coli.* against selective antibiotics (2008-2013)

Table 10: Percentage of *Escherichia coli* resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Ampicillin	67.1 [27496]	69.1 [27784]	68.9[28720]
Ampicillin/sulbactam	22.1 [11837]	24.5 [14780]	23.2[16979]
Cefotaxime	15.8 [22524]	20.2 [24880]	22.9[27020]
Ceftazidime	11.7 [26967]	14.8 [28418]	17.1[29824]
Cefoperazone/sulbactam	1.8 [9063]	2.5 [6664]	-
Ciprofloxacin	21.2 [24473]	23 [27168]	23.4[29400]
Gentamicin	11.8 [27843]	12.3 [28041]	12.8[28888]
Imipenem	0.2 [25456]	0.2 [26978]	0.3[28696]
Meropenem	0.3 [24351]	0.3 [26510]	0.3[27759]
Trimethoprim/sulphamethoxazole	43.4 [24967]	43.8 [26672]	41.5[27963]
Piperacillin/ tazobactam	2.6 [14035]	3.1 [20301]	2.9[23202]

- Imipenem and meropenem resistance is low at 0.2-0.3% and 0.3% respectively and was the same as in 2011.
- Cefotaxime resistance has reached 22.9% for the year 2013, a marked increase from 15.8% in 2011.

C. Klebsiella pneumoniae

- The resistance rates to third generation cephalosporins i.e cefotaxime and ceftazidime have increased from 2011 to 2013.
- The resistance to cefoperazone/sulbactam has also increased to 10.2% in 2012 compared to only 6.4% in 2011.
- Gentamicin resistance has increased to 15.3% in 2013, from 14.3% in 2011.
- There was an increase in meropenem resistance from 0.3% in 2011 to 1.7% in 2012.

- Number on NDM-1 cases has markedly increased over the years.

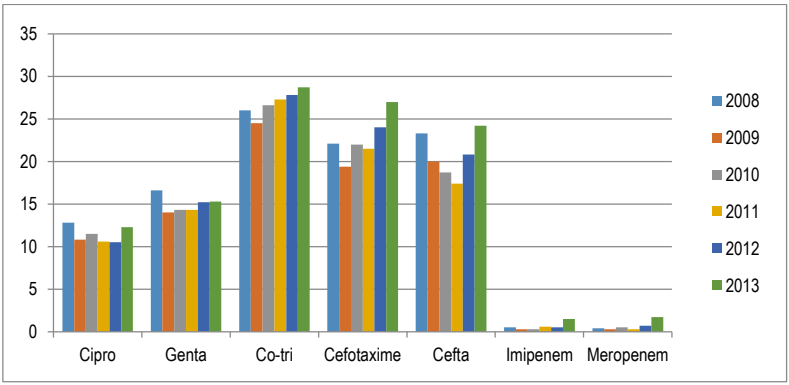


Chart 10: 6 year trend of antimicrobial resistant for *Klebsiella pneumoniae* against selective antibiotics (2008-2013)

Table 11: Percentage of *Klebsiella pneumoniae* resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Amikacin	2.2 [22910]	2.3 [23338]	3[24071]
Cefepime	12 [15131]	13.1 [16802]	15.5[19158]
Cefotaxime	21.5 [21314]	24 [20030]	27.0[21453]
Ceftazidime	17.4 [24221]	20.8 [23963]	24.2[24691]
Cefoperazone/sulbactam	6.4 [6954]	10.2 [4608]	-
Ciprofloxacin	10.6 [21255]	10.5 [22709]	12.3[23908]
Gentamicin	14.3 [24424]	15.2 [23671]	15.3[24174]
Imipenem	0.6 [22582]	0.5 [23333]	1.5[24477]
Meropenem	0.3 [21958]	0.7 [22965]	1.7[23303]
Trimethoprim/sulphamethoxazole	27.3 [22974]	27.8 [23181]	28.7[23730]

Year	Carbapenem Resistant Enterobacteriaceae	NDM-1
2010	22	1
2011	99	23
2012	173	136

2013	526	463

D. Enterobacter cloacae

Table 12: Percentage of resistance of *Enterobacter cloacae* to antibiotics

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Cefotaxime	21.5 [2288]	23.0 [2257]	25.2[7147]
Ceftriaxone	19.2 [1224]	20.5 [1451]	21.5[2781]
Ceftazidime	16.4 [2459]	19.1 [2442]	20.9[7964]
Ciprofloxacin	6.5 [2340]	5.5 [2398]	5.7[7919]
Gentamicin	10.2 [2547]	8.5 [2467]	8.2[7829]
Imipenem	0.9 [2431]	0.6 [2411]	1.5[7701]
Meropenem	0.7 [2302]	0.6 [2351]	1[7476]

- The resistance rates to third generation cephalopsorins i.e cefotaxime, ceftriaxone and ceftazidime was noted to be higher in 2013 in 2011.
- Imipenem and meropenem resistance were noted to be slightly decreased in 2012 however the rates have risen in 2013.
- The resistance to ciprofloxacin and gentamicin were noted to be lower in 2012 and 2013 compared to 2011.

E. Pseudomonas aeruginosa

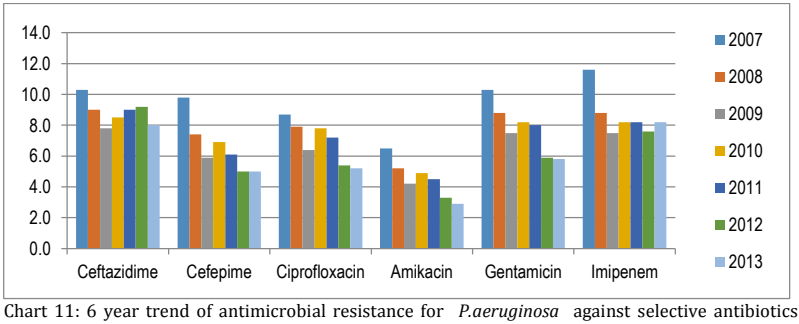


Chart 11: 6 year trend of antimicrobial resistance for *P.aeruginosa* against selective antibiotics (2007-2013)

Table 13: Percentage of *Pseudomonas aeruginosa* resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Amikacin	4.5 [20008]	3.3 [21215]	2.9[21821]
Cefepime	6.1 [19153]	5.0 [19315]	5[20716]

Ceftazidime	9.0 [20455]	9.2 [21502]	8[21866]
Ciprofloxacin	7.2 [19139]	5.4 [20740]	5.2[21694]
Gentamicin	8.0 [20441]	5.9 [21020]	5.8[21239]
Imipenem	8.2 [19875]	7.6 [20869]	8.2[21296]
Meropenem	7.3 [19518]	6.9 [19485]	8.3[20033]
Piperacilin/ tazobactam	5.8 [18418]	6.4 [19042]	4.6[19899]
Polymyxin B	0.8 [6040]	0.8 [10227]	-

- Except for imipenem and meropenem, the resistance rates in 2013 were lesser compared to 2011 (Table 13).
- Resistance to Polymixin B was 0.8%, the same as in 2011 and 2012.

F. Haemophilus influenzae

Table 14: Percentage of *Haemophilus influenzae* resistant to antibiotics.

Antibiotic	**2011 % R [no. Tested]**	**2012 % R [no. Tested]**	**2013 % R [no. Tested]**
Ampicillin	18.4 [997]	20.2 [1279]	27.2[1177]
Amoxicillin/clavulanic acid	12.2 [686]	7.3 [1171]	9.9[1103]
Cefotaxime	3.8 [999]	5.4 [988]	5.3[756]
Cefuroxime	8.0 [599]	4.4 [899]	5.2[1032]
Chloramphenicol	5.4 [896]	5.6 [1024]	7.8[986]
Trimethoprim/sulphamethoxazole	41.7 [698]	36.1 [1217]	38.9[1142]

- Ampicillin resistance has increased to 27.2% in 2013, 20.2% in 2012 compared to 18.4% in 2011 (Table 14).

G. Salmonella Typhi

Table 15: Percentage of *Salmonella Typhi* resistant to antibiotics.

Antibiotic	**2011 % R [no. Tested]**	**2012 % R [no. Tested]**
Ampicillin	26.8 [179]	3.3 [92]
Ceftriaxone	0.5 [184]	0 [91]
Ciprofloxacin	4.4 [183]	5.4 [74]
Chloramphenicol	29.4 [163]	0 [84]
Trimethoprim/sulphamethoxazole	27.5 [178]	2.2 [93]

- There were fewer number of isolates tested in the year 2012.
- No chloramphenicol or ceftriaxone resistant isolates were reported this year.

H. Salmonella spp.

Table 16: Percentage of *Salmonella* sp resistant to antibiotics.

Antibiotic	2011 % R [no. Tested]	2012 % R [no. Tested]	2013 % R [no. Tested]
Ampicillin	22.2 [1841]	20.5 [1994]	23.9[1954]
Cefotaxime	4.5 [157]	2.1 [286]	4.9[326]
Ceftazidime	1.6 [182]	2.4 [297]	3.6[329]
Ceftriaxone	2.0 [1868]	3.1 [1938]	3.3[1821]
Ciprofloxacin	1.8 [1903]	1.3 [1787]	2[1623]
Chloramphenicol	11.7 [1568]	9.4 [1750]	11[1821]
Trimethoprim/sulphamethoxazole	14.0 [1818]	11.0 [1954]	12.6[1914]

- There was a decrease in resistance rates towards cefotazime, chloramphenicol and trimethoprim/sulfamethoxazole in 2012 (Table 16).
- A slight increase in the resistant rates towards ceftazidime and ceftriaxone was noted in 2012 when compared to 2011.
- There was no resistance to meropenem.

OTHER PATHOGENS

A. Neisseria gonorrhoea

Table 18: Percentage of *Neisseria gonorrhoea* resistant to antibiotics

Antibiotic	2012 % R [no. Tested]	2011 % R [no. Tested]
Penicillin	57.1 [105]	52.9 [87]
Ceftriaxone	1.8 [109]	5.5 [91]
Ciprofloxacin	57.3 [103]	53.2 [79]
Tetracyclin	74.7 [99]	71.8 [78]

- The resistance to Penicillin G, ciprofloxacin and tetracycline has increased in 2012 compared to 2011. Ceftriaxone resistance was lower in 2012 (1.8%), compared with 5.5% of 91 isolates tested in 2011.

ANTIBIOTIC UTILISATION

Based on DDD/1000 patient-days

Groups of antibiotic – Total-Hospitals (ICU and NON-ICU)

In 2013, there are 11 groups of antibiotic that are being monitored. For all ward, the groups that shown an increase in usage are Fluoroquinolones (34.18%), Carbapenems (32.29%), Polymyxins (9.32%), Tigecycline (15.44%), Aminoglycosides (14.81%) and Penicillin/B-lactamase Inhibitor Combination(178.92%)

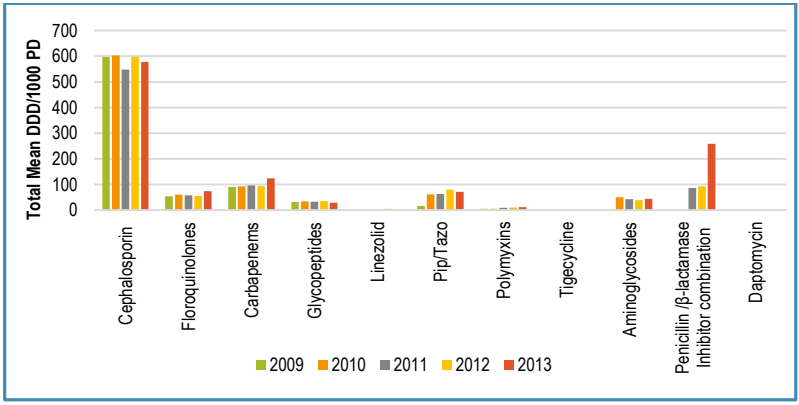


Figure 1 : Total-hospitals antibiotic usage for 5 years (MOH, University, MOD, Private Hospitals)

Group of antibiotic – ICU-only

For ICU-only, all groups of antibiotic shown an increase except for Glycopeptides. There was a tremendous increase in usage for 2013 due to voluntary data submission from a few private hospitals.

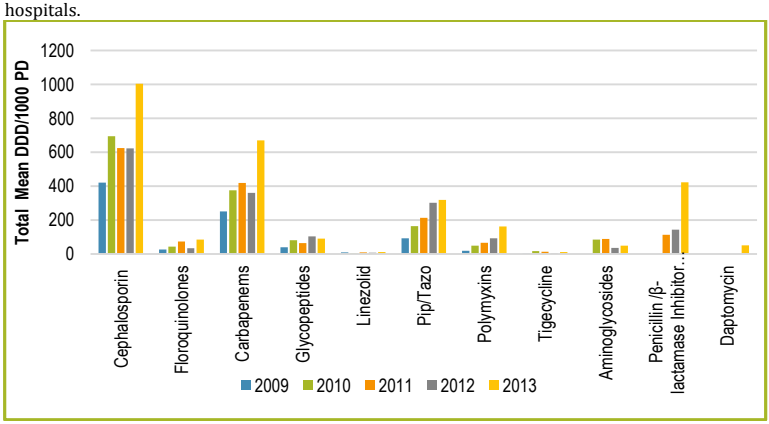
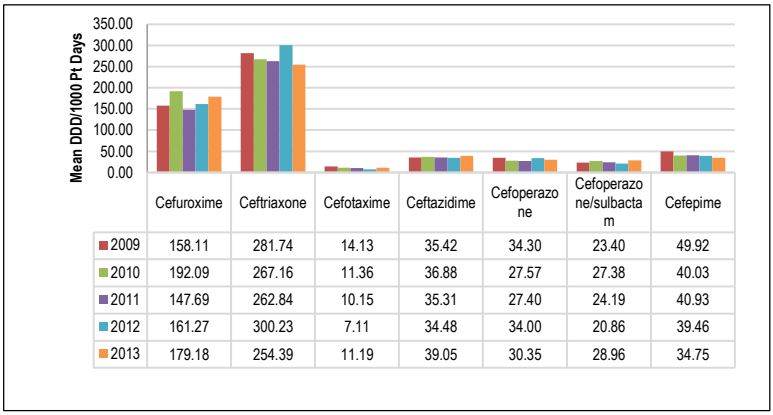


Figure 2 : ICU-only antibiotic usage for 5 years (MOH, University, MOD, Private Hospitals)

Cephalosporins

There was an increment in the use of Cefuroxime (11.1%), Cefotaxime (57.1%), Ceftazidime (13.25%) and Cefoperazone/Sulbactam (38.83%). Reduction usage was shown on Ceftriaxone (15.3%), Cefoperazone (10.7%) and Cefepime (11.9%).

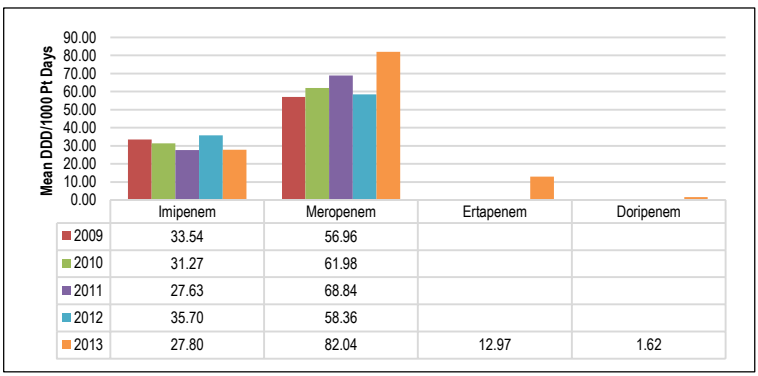


	Cefuroxime	Ceftriaxone	Cefotaxime	Ceftazidime	Cefoperazone	Cefoperazone/sulbactam	Cefepime
2009	158.11	281.74	14.13	35.42	34.30	23.40	49.92
2010	192.09	267.16	11.36	36.88	27.57	27.38	40.03
2011	147.69	262.84	10.15	35.31	27.40	24.19	40.93
2012	161.27	300.23	7.11	34.48	34.00	20.86	39.46
2013	179.18	254.39	11.19	39.05	30.35	28.96	34.75

Figure 3 : Use of Cephalosporin Injections in MOH and Non-MOH Hospitals (2009-2013)

Carbapenems

There was an increment in the use of Meropenem (40.6%) while a reduction in usage shown in Imipenem (22.1%). Data collection for Ertapenem and Doripenem had just started in 2013

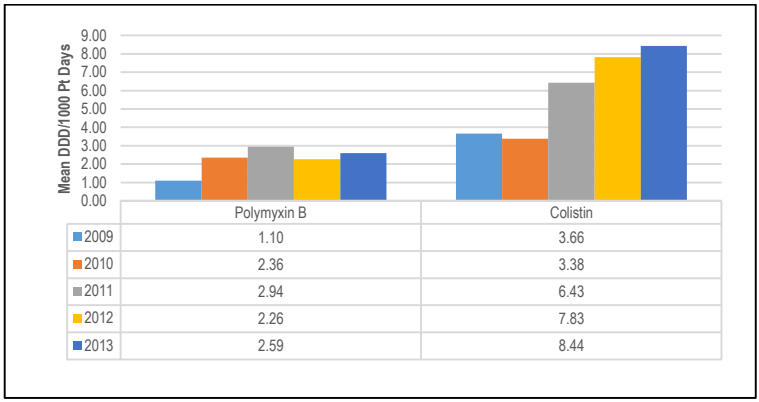


	Imipenem	Meropenem	Ertapenem	Doripenem
2009	33.54	56.96		
2010	31.27	61.98		
2011	27.63	68.84		
2012	35.70	58.36		
2013	27.80	82.04	12.97	1.62

Figure 3 : Use of Carbapenem Injections in MOH and Non-MOH Hospitals (2009-2013)

Polymyxins

The usage of Colistin is gradually increasing from 2011 to 2013 and most of the usage are in ICU setting.



	Polymyxin B	Colistin
2009	1.10	3.66
2010	2.36	3.38
2011	2.94	6.43
2012	2.26	7.83
2013	2.59	8.44

Figure 4 : Use of Polymyxins Injections in MOH and Non-MOH Hospitals (2009-2013)

SECTION A
ADULT

CARDIOVASCULAR INFECTIONS

A. INFECTIVE ENDOCARDITIS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Empirical Treatment			
	Benzylpenicillin 4MU IV q4h (total 24MU/24h) or 24MU IV continuously **PLUS** Gentamicin 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 2gm IV q4h **PLUS** Gentamicin 1mg/kg IM/IV q8h		Treatment can be modified once the blood result is known
Viridans streptococci & *Streptococcus bovis* It is recommended MIC estimation is done for these isolates to faclitate management			
Native and Prosthetic Valves MIC: < 0.12µg/mL Penicillin-Susceptible Viridans Streptococci *& Streptococcus bovis*	Benzylpenicillin 2-3MU IV q4h (total 12-18MU/24h) or IV continuously for 4 weeks (native valves) or 6 weeks (prosthetic valves)	Ceftriaxone 2gm IV/IM q24h for 4 weeks **Penicillin Allergy:** Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 4 weeks (native valves) or 6 weeks (prosthetic valves); not to exceed 2 gm/day unless serum level are monitored	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 4MU IV q4h (total 24MU/24h) or 24MU IV continuously for 4 weeks **PLUS** Gentamicin 3mg/kg IM/IV q24h for 2 weeks	Ceftriaxone 2gm IV/IM q24h for 4 weeks **PLUS** Gentamicin 3mg/kg IV/IM q24h for 2 weeks If unable to tolerate Penicillin/Ceftriaxone: Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 4 weeks, not to exceed 2gm/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-relatively resistant or fully resistant Viridans Streptococci *& Streptococcus bovis*	Benzylpenicillin 4MU IV q4h (total 24MU/24h) or 24MU IV continuously for 6 weeks **PLUS** Gentamicin 3mg/kg IV/IM q24h for 6 weeks	Ceftriaxone 2gm IV/IM q24h for 4 weeks **PLUS** Gentamicin 3mg/kg IV/IM q24h for 2 weeks If unable to tolerate Penicillin/Ceftriaxone: Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 4 weeks, not to exceed 2gm/24h (unless serum levels are monitored)	
** Enterococcus (It is recommended that all these isolates are tested for high level resistance (HLR) to Gentamicin)			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Native and Prosthetic Valves Enterococcal Endocarditis sensitive to Gentamicin	Ampicillin 2gm IV q4h for 4-6 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 4-6 weeks	Benzylpenicillin 18-30MU /24h IV in 4-6 equally divided doses for 4-6 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 4-6 weeks **OR** Ampicillin/Sulbactam 3gm IV q4h for 4-6 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 4-6 weeks **Penicillin Allergy:** Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 6 weeks, not to exceed 2gm/24h (unless serum levels are monitored) **PLUS** Gentamicin 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 Cephalosporins are not acceptable alternatives for patients allergic to penicillin
Staphylococcus aureus			
Native Valves Methicillin-Susceptible Staphylococci	Left sided endocarditis and complicated right sided (see comments): Cloxacillin 2gm IV in q4h for 6 weeks **PLUS/MINUS** Gentamicin 1mg/kg IV/IM q8h for 3-5 days	Regimen for β-lactam allergic patients: <u>Immediate type hypersensitivity to penicillin (anaphylaxis)</u>: Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 6 weeks, not to exceed 2gm/24h (unless serum levels are	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**	
	Right sided endocarditis (tricuspid valve) in uncomplicated endocarditis (see comments): Cloxacillin 2gm IV q4h for 2 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 2 weeks	monitored) <u>For non-immediate type hypersensitivity</u>: Cefazolin 2gm IV q8h for 6 weeks **PLUS/MINUS** Gentamicin 1mg/kg IM/IV q8h for 3-5 days	Vancomycin is inferior to Cloxacillin for treatment of MSSA. Vancomycin therapy is recommended **only** for patients with immediate-type penicillin hypersensitivity.
Prosthetic Valves Methicillin-Susceptible Staphylococci	Cloxacillin 2gm IV in q4h for > 6 weeks **PLUS** Rifampicin 300mg PO q8h for > 6 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 2 weeks	Regimen for *β-lactam* allergic patients: <u>Immediate type hypersensitivity to Penicillin (anaphylaxis)</u>: Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for > 6 weeks, not to exceed 2gm/24h (unless serum levels are monitored) **PLUS** Rifampicin 300mg PO q8h for > 6 weeks **PLUS** Gentamicin 1mg/kg IM/IV q8h for 2 weeks <u>For non-immediate type hypersensitivity</u>: Cefazolin 2gm IV q8h for 6 weeks **PLUS** Rifampicin 300mg PO q8h for > 6 weeks **PLUS**	If Cefazolin is not available, use of Cefuroxime may be considered

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
		Gentamicin 1mg/kg IM/IV q8h for 2 weeks	
Native Valves Methicillin-Resistant Staphylococci	Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 6 weeks, not to exceed 2gm/24h (unless serum levels are monitored)		
Prosthetic Valves MRSA	Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for > 6 weeks, not to exceed 2gm/24h (unless serum levels are monitored) **PLUS** Rifampicin 300mg PO q8h for > 6 weeks **PLUS** Gentamicin 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	Ceftriaxone 2gm IV/IM q24h for 4 weeks (native valve) or 6 weeks (prosthetic valve)	Ampicillin/Sulbactam 3gm IV q6h for 4 weeks (native valve) or 6 weeks (prosthetic valve) **PLUS** Gentamicin 1mg/kg IM/IV q8h for 2 weeks **OR** Ampicillin 2gm IV q4h for 4 weeks (native valve) or 6 weeks (prosthetic valve) **PLUS**	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
		Gentamicin 1mg/kg IM/IV q8h for 2 weeks **OR** Ciprofloxacin 400mg IV q12h or 500mg PO q12h for 4 weeks (native valve) or 6 weeks (prosthetic valve)	
Therapy for Culture-Negative Endocarditis - Consultation with an infectious disease specialist needed			
Native Valves	Ampicillin/Sulbactam 3gm IV q6h for 4-6 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 4-6 weeks	Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 4-6 weeks **PLUS** Gentamicin 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 25-30mg/kg loading dose then 15mg/kg IV q12h for 6 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 2 weeks **PLUS** Cefepime 2gm IV q8h for 6 weeks **PLUS** Rifampicin 300mg PO/IV q8h for 6 weeks		
Prosthetic valve (late, >1 y)	Ampicillin/Sulbactam 3gm IV q6h for 4-6 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	4-6 weeks **PLUS** Rifampicin 300mg PO/IV q8h for 6 weeks		
Suspected *Bartonella*, culture negative	Ceftriaxone 2gm IV/IM q24h for 6 weeks **PLUS** Gentamicin 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 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	
Therapy for *Candida* Endocarditis (Native and Prosthetic valve)			
Candida Endocarditis (native and prosthetic valve)	Amphotericin B 0.6 -1.0mg/ kg IV q24h **PLUS/MINUS** Flucytosine 100mg/kg/day PO q6-8h		Step down therapy: Fluconazole 400 – 800mg (6 – 12mg/kg) orally daily for susceptible organism in stable patients with negative blood cultures For synergistic effect Causes dose related marrow toxicity Avoid using in patients with renal failure

- Valve replacement is mandatory. Continue therapy for 6 weeks after replacement or longer in patient with perivalvular abscess
- If prosthetic valve cannot be replaced, lifelong suppressive therapy with Fluconazole 400mg (6mg/kg) daily is recommended
- The duration of therapy will depend on patient response and surgical intervention
- All patients with *Candida* IE should be referred to ID physician

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Catether related infections Non- tunneled central venous catheter (subclavian,internal jugular) Pepriherally inserted central cathether *S. epidermidis* *S. aureus*	Vancomycin 1gm IV stat and q12h		Catheter management is important Diagnosis of IV line infection: Fever & +ve blood culture from line & peripheral vein CID 2009 Need to remove catheter as very low cure rates: KDOQI 2006, CID 2009
Tunnel type indwelling venous catheters and ports (Broviac,Hickman) Haemodialysis catheter CoNS, *S.epidermidis, S.aureus,* Gram negative rods	Vancomycin 1gm IV q12h To consider gram negative coverage with 3rd gen. Cephalosporins e.g. Ceftazidime 2gm IV q8h		

Footnotes for antibiotic treatment of endocarditis:

1. Vancomycin: aim for serum trough level of 10 – 14 µmol/L (15 – 20mg/L) for both adults and paediatrics. Vancomycin dose should be adjusted in patients with renal impairment. For dosing adult patients with renal impairment, obese patients and monitoring recommendations refer to Appendix 2 (Antibiotic Dosage in Adult with Impaired Renal Function).
2. Gentamicin: for obese patients use ideal body weight. Monitor gentamicin levels weekly. Aim for gentamicin peak level (one hour after injection) of 6 – 10 µmol/L (3 – 5mcg/mL) and trough level of <2 µmol/L (<1mcg/mL) when 2 – 3 divided doses are used. Refer to Appendix 1 (Clinical Pharmacokinetic Guidelines (Aminoglycosides & Vancomycin)).
3. There should be a high tendency for stopping Gentamicin in patients with deteriorating renal function or other signs of toxicity.
4. If there is high level gentamicin resistance (i.e. MIC >128 mg/L) Ampicillin/Sulbactam or Vancomycin will need to be continued for ≥6 weeks. Referral to an ID physician is recommended if high level Gentamicin resistance is present.
5. Rifampicin should always be used in combination with another effective antistaphylococcal drug (ideally two active agents, ie. Cloxacillin) to minimize risk of resistance. Rifampicin increases hepatic clearance of warfarin and other drugs.

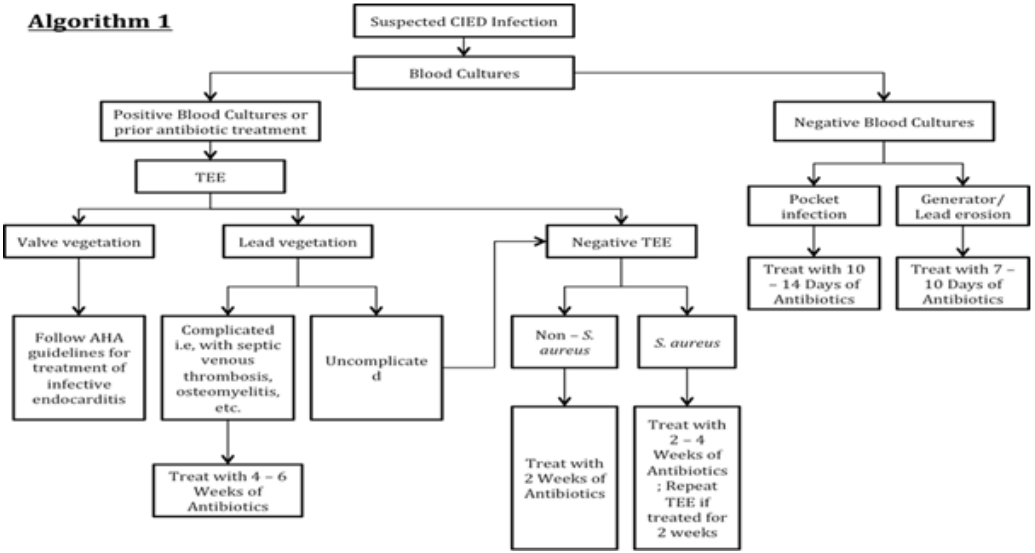
B. TREATMENT OF PACEMAKER INFECTIONS

Antibiotic	Duration	Comments
While awaiting microbiological diagnosis provide empirical cover for MRSA with: Vancomycin 25-30mg/kg loading dose then 15mg/kg IV q12h for 6 weeks, not to exceed 2gm/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 Aim for serum trough level of 10 – 14µmol/L (15 – 20mg/L)

Duration of treatment (see Algorithm 1)

Duration of antibiotic should be counted from the day of device explantation or CIED removal.

Complete removal of the entire implanted system including the cardiac leads is recommended even in patients with clinical infection of the pocket only.



Diagrams adapted from: Gould, F.K., et al. Guidelines for the diagnosis and antibiotic treatment of endocarditis in adults: a report of the Working Party of the British Society for Antimicrobial Chemotherapy. J Antimicrob Chemother 2012; 67: 269–289

Infection/ Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Empirical therapy for Sternal Wounds	Cloxacillin 1-2gm IV q6h **PLUS** Gentamicin 5mg/kg IV given as a single daily dose	Piperacillin/Tazobactam 4.5gm IV q8h Vancomycin 25 – 30mg/kg loading dose then 15mg – 20mg/kg IV q12h, not to exceed 2 gm/24h unless serum levels are monitored	Duration of treatment will depend on the severity of the wound infection; minimum 1 week. If osteomyelitis treat for 4 – 6 weeks Duration of treatment will depend on the severity of the wound infection; minimum 1 week (treat until patient is afebrile and wound is granulating). Aim for serum trough level of 10 – 14µmol/L (15 – 20mg/L)

References:

1. Baddour LM, Epstein AE, Erickson CC et al. Update on cardiovascular implantable electronic device infections and their management: A scientific statement from the American Heart Association. Circulation. 2010; 121:458-477.
2. RHDAustralia (ARF/RHD writing group), National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand. *Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (2nd edition)*. 2012
3. Baddour LM, Wilson WR, Bayer AS et al. Infective Endocarditis: Diagnosis, Antimicrobial Therapy, and Management of Complications: A Statement for Healthcare Professionals From the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease, Council on Cardiovascular Disease in the Young, and the Councils on Clinical Cardiology, Stroke, and Cardiovascular Surgery and Anesthesia, American Heart Association: Endorsed by the Infectious Diseases Society of America. Circulation. 2005;111:394-434
4. European Society of Cardiology (ESC). Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009). European Heart Journal. 2009; 30:2369-2413.
5. Nishimura RA, Carabellow BA, Faxon DP. ACC/AHA 2008 Guideline Update on Valvular Heart Disease: Focused Update on Infective Endocarditis: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: Endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. Circulation. 2009; 118:887-896.
6. Gould FK, Denning DW, Elliot TSJ et al. Guidelines for the diagnosis and antibiotic treatment of endocarditis in adults: a report of the Working Party of the British Society for Antimicrobial Chemotherapy. J Antimicrob Chemother. 2012; 67:269-289.
7. Wilson W, Taubert KA, Gewitz M et al. Prevention of Infective Endocarditis: Guidelines From the American Heart Association: A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. Circulation. 2007;116:1736-1754

CENTRAL NERVOUS INFECTIONS

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:** Ceftriaxone 2gm IV q12h. **OR** Cefotaxime 2-4gm IV q8h.	If no clinical response after 3 days of antibiotics: Meropenem 2.0gm IV q8h. Dexamethasone 10mg IV 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 14 days.
Causative organism isolated:			
Haemophilus influenzae (Gram-ve bacilli)	Ceftriaxone 2gm IV q12h **OR** Cefotaxime 2-4gm IV q8h **OR** Ceftazidime 2gm IV q8h. Duration of treatment: 10-14 days. (very ill patients may require treatment for 21 days.)	Meropenem 2.0gm IV q8h **OR** Cefepime 2gm IV q12h. **If organism is susceptible:** Chloramphenicol 1gm IV q6h for 14 days.	
Streptococcus pneumoniae (Gram +ve cocci)	**Penicillin-sensitive strains** Benzylpenicillin 4MU IV q4-6h for 10-14 days.	**For penicillin resistant strains** Vancomycin 1gm IV q12h **PLUS** Ceftriaxone 2gm IV q12h	Tunkel, et al. Practice Guidelines for the Management of Bacterial Meningitis. Clin Inf Dis 2004; 39:1267-84.

Infection/ Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Relatively-resistant strains Ceftriaxone 2gm IV q12h **OR** Cefotaxime 2-4gm IV q8h for 10-14 days Duration of treatment: 10-14 days.(very ill patients may require treatment for 21 days.)	**OR** Cefotaxime 2-4gm IV q8h **OR (either)** 1. Meropenem 2.0gm IV q8h 2. Cefepime 2gm IV q12h. 3. Fluroquinolone **PLUS** Rifampicin	
Neisseria meningitidis (Gram –ve cocci) Prophylaxis for household and close contacts for meningococcal meningitis	Ceftriaxone 2gm IV q12h **OR** Cefotaxime 2-4gm IV q8h **OR** Ceftazidime 2gm IV q8h. Ciprofloxacin 500mg PO as single dose; **OR** Rifampicin 600mg PO q12h for 2 days (4 doses) [not recommended in pregnant women].	Chloramphenicol 1gm IV q6h. 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. East Kent Hospitals University Foundation Trust Antimicrobial Guidelines, 2012.
Gram-negative *Enterobacteriaceae*	Ceftriaxone 2gm IV q12h. **OR** Cefotaxime 2-4gm IV q8h. Duration of treatment: 10-14 days. (Very ill patients may require treatment for 21 days.)		References. Woehrl B, Klein M,Grandgirard D, Koedel U, Leib S. Bacterial meningitis: current therapy and possible future treatment options *Expert Rev Anti Infect Ther 2011;* 9(11), 1053–1065. Tunkel, et al. Practice Guidelines for the Management of Bacterial Meningitis. Clin Inf Dis 2004; 39:1267-84.

Infection/ Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Viral encephalitis *Herpes simplex* *Herpes zoster* *Cytomegalovirus (CMV)* In immunocompromised patients Induction phase: Maintenance phase:	Acyclovir 500mg IV q8h for 14-21 days. (Duration of treatment may be extended to 21 days in severe cases or in immunosuppressed patients.) Ganciclovir 5mg/kg IV q12h for 21 days. Ganciclovir 5mg/kg IV q24h for 6 months depending on severity of disease, time to response and end organ involvement. May switch to oral.	Valganciclovir 900mg PO q12h Valganciclovir PO 900mg PO q24h for 6 months depending on severity of disease, time to response and end organ involvement.	References: Chaudhuir A, Kennedy P G E.Diagnosis and treatment of viral encephalitis. *Postgrad Med J 2002;* 79: 575-583. Tunkel, et al. The Management of Encephalitis: Clinical Practice Gudielines by the Infectious Diseases Society of America. *Clin Inf Dis 2008; 47: 303-327*. Torres-Madriz, G., Boucher, H. W. Perspectives in the Treatment and Prophylaxis ofCytomegalovirus Disease in Solid-Organ Transplant Recipients. *Clin Infect Dis*., 2008; 47 (5): 702-711.
Meningitis (Chronic)			
Tuberculous meningitis *(Mycobacterium tuberculosis)*	Intensive 2 months S/EHRZ **and** 10 months HR Isoniazid (H) 5 (4-6) mg/kg/24h PO (max: 300 mg/day) **PLUS** Rifampicin (R) 10 (8-12) mg/kg/24h PO (max: 600 mg/day) **PLUS**	Infection in HIV patients: Recommendations for the treatment of TB in HIV-infected adults are **identical** to those for HIV-uninfected adults when the disease is caused by organisms that are **known or presumed to be susceptible to the first-line drugs**. Daily dosing is recommended rather than intermittent dosing.	Medium dose steroid cover for MRC stage 2 and 3 patients: Dexamethasone 12 - 16 mg daily in divided doses for 6 weeks in tapering doses (intravenously initially, then switch to oral when safe to do so). Alternatively, oral prednisolone 30-40mg/24h in tapering doses for 6 weeks. Reference:

Infection/ Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Pyrazinamide (Z) 25 (20-30) mg/kg/24h PO (max: 2000 mg/day) **PLUS** Streptomycin (S) 15 (12-18) mg/kg/24h IM (max: 1000 mg/day) Pyridoxine 10- 50mg PO q24h needs to be prescribed together with Isoniazid. (Streptomycin should replace Ethambutol in TB meningitis as it crosses BBB better than Ethambutol.) Treatment is continued for 12 months.	Rifampicin is not recommended in combination with all protease inhibitors (PIs) and rifabutin should be used with PI-based HAART for HIV-TB co-infected adults. <u>MDR-TB</u>: Combination of one drug from each of the groups below:- Group 1 – Pyrazinamide, Ethambutol, Rifabutin* Group 2 – Kanamycin*, Amikacin, Capreomycin* (if resistant to Kanamycin or Amikacin) Group 3 – Levofloxacin, Moxifloxacin Group 4 – Ethionamide*, Cycloserine*, p-Aminosalicylic Acid (PAS)* Group 5 – not routinely used except in XDR-TB:Clofazimine*, Linezolid, Amoxicillin/Clavulanate, Clarithromycin, Imipenem	CPG on management of Tuberculosis, 3rd edition, 2012; 16, 22, 40-42, 56) WHO Treatment of Tuberculosis Guidelines, 4th ed. 2009 *Requires DG approvals
Cryptococcal meningitis *Cryptococcus neoformans*	**Induction Therapy**: Amphotericin B 0.7-1.0mg/kg/24h IV **PLUS** 5-Flucytosine 100-150mg/kg/24h PO q6h for 2-4 weeks. **OR**	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.	End point of treatment: till at least total of 1.5-2.0gm 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.

Infection/ Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Fluconazole 400mg PO q24h. **Consolidation Therapy**: Fluconazole 400-800mg PO q24h for 8 weeks.	**If Fluconazole is not tolerated:** Itraconazole 200mg PO q12h	Liposomal Amphotericin may be used in cases of severe toxicity to Amphotericin B e.g. Abelcet 3-5mg/kg/day References: *Clin Infect Dis.* Jul 1 2008; 47(1):123-30. *Clin Inf Dis 2010; 50: 291-322.* *N Eng J Med* 2013; 368: 1291-1302. *Antimicrobial Agents And Chemotherapy* 2007;51(3): 1038-1042
Neurosyphilis	Refer to section (Sexually Transmitted Infections)		Treatment same for neurosyphillis in patients with HIV infection Reference: 2010 CDC STD Treatment Guidelines; 32-33.
HIV related CNS infection	Refer to section (Human Immunodeficiency Virus)		

CHEMOPROPHYLAXIS

SURGICAL

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 stabilized 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

Pre-operative dose timing: The optimal time for administration of preoperative doses is within 60 minutes before surgical incision. Some agents, such as Clindamycin, Fluoroquinolones, Gentamicin, Metronidazole and Vancomycin, require administration over one to two hours; therefore, the administration of these agents should begin within 120 minutes before surgical incision (Reference: Am J Health-Syst Pharm Vol 70: 195-283, 2013@IDSA.

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 & GYNAECOLOGY			
Cesarean Section a. Elective b. Emergency	Cefazolin 2gm IV	1st or 2nd gen Cephalosporins, e.g. Cefuroxime 750mg IV **Penicillin Allergy:** Clindamycin 600mg IV **OR** Erythromycin Lactobionate 500mg IV	Consider doubling the dose if BMI >35. To give second dose if surgery more than 3 hours or blood loss more than 1.5L.
Elective surgery TAHBSO Hysterectomy (vaginal or abdominal) Laparascopy vagina and/or uterus entered	1st or 2nd gen. Cephalosporins, e.g. Cefuroxime 750mg IV	**Penicillin Allergy:** Clindamycin 900mg IV **PLUS** Gentamicin 5mg/kg IV **OR** Ampicillin/Sulbactam 3gm IV	Consider to give second or additional dose for prolonged procedures.
Laparoscopic surgery Vagina and/or uterus not entered	Antibiotic not recommended	Antibiotic not recommended	
Repair of Perineal Tear e.g. third or fourth degree tears	Cefuroxime 1.5gm IV **PLUS** Metronidazole 500mg IV		Continued for 5-7days.
Emergency Laparotomy	As per elective surgery		

Reference (as per recommended standards):
1. Antibiotic Prophylaxis in GynecologyProcedure – SOGC Clinical Practice Guideline no 275, April 2012
2. Antibiotic Prophylaxis in Obstetric Procedure - SOGC Clinical Practice Guideline no 247, September 2010

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
2. OTORHINOLARYNGOLOGY SURGERY			
Head and neck			
Clean	Antibiotic not required	Antibiotic not required	
Clean with placement of prosthesis (excludes tympanostomy tubes)	Cefazolin 2gm IV/ 3gm IV for patients weighing ≥120 kg **OR** Cefuroxime 1.5gm IV	**β -lactam Allergy:** Clindamycin 900 mg IV	
Clean-contaminated cancer surgery Other clean-contaminated procedures with the exception of tonsillectomy and functional endoscopic sinus procedures	Cefazolin 2gm IV **PLUS** Metronidazole 500mg IV **OR** Cefuroxime 1.5gm IV **PLUS** Metronidazole 500mg IV **OR** Ampicillin/Sulbactam 3gm IV	**β -lactam Allergy:** Clindamycin 900 mg IV	Redosing: Procedure longer than 4 hours for Cefazolin or Cefuroxime, and 2 hours for Ampicillin/Sulbactam

For procedures in which pathogens other than staphylococci and streptococci are likely, an additional agent with activity against those pathogens could be considered. For example, if there are surveillance data showing that gram-negative organisms are a cause of surgical-site infections (SSIs) for the procedure, practitioners may consider combining Clindamycin or Vancomycin with another agent (Cefazolin if the patient is not β -lactam allergic; gentamicin, or single-dose fluoroquinolone if the patient is β -lactam allergic).

References:

1. Am J Health-Syst Pharm. 2013; 70:195-283, 2013@IDSA
2. Weber RS, Callender DL. Antibiotic prophylaxis in clean-contaminated head and neck oncologic surgery. *Ann Otol Rhinol Laryngol.* 1992; 101:16- 20
3. Johnson JT, Wagner RL. Infection following uncontaminated head and neck surgery. *Arch Otolaryngol Head Neck Surg.* 1987; 113:368-9.
4. Saginur R, Odell PF, Poliquin JF. Antibiotic prophylaxis in head and neck cancer surgery. *J Otolaryngol.* 1988; 17:78-80.
5. Simo R, French G. The use of prophylactic antibiotics in head and neck oncological surgery. *Curr Opin OtolaryngolHead Neck Surg.* 2006; 14:55-61
6. Strauss M, Saccogna PW, Allphin AL. Cephazolin and metronidazole prophylaxis in head and neck surgery. *J Laryngol Otol.* 1997; 111:631-4.
7. Skitarelić N, Morović M, Manestar D. Antibiotic prophylaxis in clean contaminated head and neck oncological surgery. *J Craniomaxillofac Surg.*2007; 35:15-20.
8. National Institute for Health and Clinical Excellence. Surgical site infection (clinical guideline 74) 2008. www.nice.org.uk/CG74 (accessed 2012 Dec 9).

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
9. Fennessy BG, Harney M, O'Sullivan MJ et al. Antimicrobial prophylaxis in otorhinolaryngology/head and neck surgery. *Clin Otolaryngol.* 2007; 32:204-7. 10. Seven H, Sayin I, Turgut S. Antibiotic prophylaxis in clean neck dissections. *J Laryngol Otol.* 2004; 118:213-6 11. Slattery WH III, Stringer SP, Cassisi NJ. Prophylactic antibiotic use in clean, uncontaminated neck dissection. *Laryngoscope.* 1995; 105:244-6.			
3. ORAL / DENTAL SURGERY			
Clean Surgery (Class 1) • Submandibular gland surgery • TMJ surgery • Excision of benign tumours / cysts Minor Clean-contaminated surgery (Class 2) • soft tissue surgery • dentoalveolar surgery • periodontal surgery	Not Indicated for most surgeries May be indicated i. if the duration of the surgery is expected to be very long ii. for open reduction and internal fixation of facial bone fractures		Prophylaxis is recommended for all patients with an increased risk of surgical wound infection - i.e. in immunocompromised patients
Minor Clean-contaminated surgery (Class 2) • insertion of dental implants and use of graft material • high degree of difficulty / long duration	Amoxycillin 1gm PO **OR** Clindamycin 600mg PO/IV **OR** Benzyl penicillin 2MU IV	Amoxycillin/Clavulanate 1.2gm PO/IV **OR** Cefuroxime 500mg PO/ 1.5gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	
Major Clean-contaminated surgery (Class 3) • Orthognathic surgery • Excision / enucleation of large benign tumours / cysts • All oral cancer surgery • Open reduction and internal fixation of facial bone fractures	Benzyl penicillin 2MU IV **OR** Clindamycin 600mg IV	Amoxycillin/Clavulanate 1.2gm IV **OR** Cefuroxime 1.5gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	For oral & maxillofacial fractures, antibiotics is recommended for the immediate post trauma period and should be discontinued once open reduction and internal fixation is completed
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 2014)			
4. PLASTIC SURGERY			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Lip repair, palatoplasty/ pharyngoplasty Commonest organism : skin,oral and nasal pathogens	Ampicillin/Sulbactam 1.5gm IV	Erythromycin Lactobionate 500mg IV	
Cranio-facial surgery Maxillo-facial surgery Commonest organism: skin,oral and nasal pathogens	Metronidazole 500mg IV **PLUS** Cefuroxime1.5gm IV **OR** Ceftriaxone 2gm IV (if craniotomy required)	Ampicillin/Sulbactam 1.5gm IV	Cephalosporin usage as a prophylaxis against meningitis/encephalitis
Facial injuries	Cloxacillin 500mg-1gm IV	Cefuroxime 1.5gm IV **OR** Ampicillin/Sulbactam1.5gm IV	Gross contamination of skin pathogen
Hand replantation	Cefuroxime 1.5gm IV	Ampicillin/Sulbactam1.5gm IV	Gross contamination of skin pathogen Prophylaxis against tenosynovitis
5. BURNS			
General burn	Antibiotic not recommended	Antibiotic not recommended	Prophylatic antibiotics are not routinely given to burn patients as they do not reduce the risk of infection
SSG/ Debridement	Cloxacillin 1gm IV **OR** Ampicillin/Sulbactam 3gm IV **OR** Cefazolin 1-2gm IV	**Penicllin Allergy:** Clindamycin 900mg IV MRSA Colonized patients: Vancomycin 15mg/kg IV	Redosing may also be warranted if there are factors that shorten the half-life of the antimicrobial agent (e.g., extensive burns).
CPG: Burn Patient Management (ACI Statewide Burn Injury Service), August 2011.			
6. VASCULAR SURGERY			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Vascular graft implants a. AVF graft MRSA infection prophylaxis b. Aortic graft / TEVAR / EVAR Suspected organism: *Staph.* spp. & anaerobic organism	Vancomycin 1gm IV Amoxycillin/Clavulanate 1.2gm IV	Linezolid 600mg IV Ampicillin/Sulbactam 1.5gm IV	
Ischemic limb Suspected organism: *Staph.* spp. & anaerobic organism	Ampicillin/Sulbactam 1.5-3gm IV	Amoxycillin/Clavulanate 1.2gm IV	
7. HEPATOBILIARY SURGERY			
Open Cholecystectomy ERCP+stent	Cefuroxime 1.5gm IV	Ampicillin/Sulbactam 1.5gm IV	
Laparoscopic Cholecystectomy	Antibiotic not recommended	Antibiotic not recommended	
8. GENERAL SURGERY			
Upper GIT oesophagus, stomach & upper small bowel	Amoxycillin/Clavulanate 1.2gm IV	Cefotaxime 1gm IV **OR** Cefoperazone 1gm IV	
Distal small bowel colorectal	Cefuroxime 1.5gm IV **PLUS** Metronidazole 500mg IV **OR** Amoxycillin/Clavulanate 1.2gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	Cefoperazone 1gm IV **PLUS** Metronidazole 500mg IV	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Hernia repair with mesh	Cloxacillin 1gm IV	Amoxycillin/Clavulanate 1.2gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	Includes laparoscopic repair
Breast Mastectomy with axillary clearance with/without reconstruction	Cloxacillin 1gm IV	Amoxycillin/Clavulanate 1.2gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	Not recommended for minor excisions
9. ORTHOPAEDIC SURGERY			
Internal fixation of all closed fracture Total Joint Replacement/ Spine surgery & Arthroscopy	Cloxacillin 1gm IV	Cefuroxime 1.5gm IV, continue 750mg IV q8h (3 doses) post-operation; **OR** Cefazolin 1-2gm IV	30-45 minutes before skin incision and before tourniquet inflation
Gun shot and other penetrating wounds Likely organisms: *Staphylococcus* *Clostridium* spp.	Cloxacillin 1gm IV **OR** Cefuroxime 1.5gm IV **PLUS** Metronidazole 500mg IV	Amoxycillin/Clavulanate 1.2gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	Thorough surgical debridement
Muscular, skeletal and soft tissue trauma, crush injuries and stab wounds	Cloxacillin 1-2gm IV q6h **OR** Cefazolin 1-2gm IV q8h **PLUS** Gentamicin 1.5mg/kg IV q8h **PLUS** Metronidazole 500mg IV q8h Duration: Should not be less than 5 days	Cefuroxime 1.5gm IV as a loading dose followed by 750mg IV q8h **PLUS** Metronidazole 500mg IV q8h Duration: Should not be less than 5 days	In all cases, a patient's tetanus immunization status should be assessed

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Compound fractures	Cloxacillin 1gm IV q6h **OR** Cefazolin 1-2gm IV q8h If wound soiling or tissue damage is severe and/or devitalized tissue is present: **PLUS** Gentamicin 5mg/kg q24h **PLUS** Metronidazole 500mg IV q8h	Cefuroxime 1.5gm IV as a loading dose followed by 750mg IV q8h	In all cases, a patient's tetanus immunization status should be assessed Duration(based on the grade of fracture): Grade1: 2 weeks Grade2: 2-4 weeks Grade3: 2-6 weeks
Amputations for Diabetic wounds and Ischaemic limbs			
Polymicrobial Infection Likely organism: *Staphylococcus aureus, Streptococcus* spp. *Enterobacteriaceae*	Ampicillin/Sulbactam 1.5-3gm IV **OR** Ceftriaxone 1 gm IV **PLUS/MINUS** Metronidazole 1.5gm IV followed by 750mg IV	Ampicillin/Sulbactam 375mg PO q12h **OR** Ertapenem 1gm IV OD	Complete amputation of all dead and necrotic tissue. Moderate or severe infection: - Erythema more than 2cm involving deeper tissues, e.g. abcess, osteomyelitis, septic arthritis, fasciitis **WITH/WITHOUT:** -Temperature >38ºC or <36ºC -Heart rate >90BPM/ -Resp rate>20/min -PaCO2 <32mmHg -White cell count >12000 or <4000cells/uL Initial parental then switch to oral
10. UROLOGICAL SURGERY			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
A. Diagnostic Procedures			
Transrectal ultrasound and prostate biopsy *E.coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Ciprofloxacin 500mg PO q12h	Trimethoprim/ Sulfamethoxazole 160/800mg PO q12h	Start 1- 2 days before procedure. Continue up to 3-5 days (Pre-emptive therapy)
Cystoscopy/ Urodynamics study/ Retrograde pyelogram/Ureteric stenting	Antibiotic not recommended	Antibiotic not recommended	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
B. Endourology			
Endourological surgery *e.g.* PCNL,URS,RIRS,TURP *E.coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Amoxycillin/Clavulanate 1.2gm IV **OR** Ampicillin/Sulbactam 1.5gm IV	Cefoperazone 1gm IV	
C. Open Surgery			
Clean operations e.g. orchidectomy, orchidopexy, varicocelectomy, deroofing renal cysts	Antibiotic not required	Antibiotic not required	
Clean-contaminated (with opening of urinary tract) e.g. nephrectomy, prostatectomy, open stone surgery.	Amoxycillin/Clavulanate 1.2gm IV q8h **OR**	Cefoperazone 1gm IV q12h for 1 day	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
E.coli, Klebsiella, Proteus, Enterococcus, Pseudomonas	Ampicillin/Sulbactam 1.5gm IV q8h for 1 day		
Clean-contaminated (with use of bowel segments) e.g. Cystectomy with urinary diversion, cystoplasty. *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas,* Anaerobes	Cefoperazone 1gm IV q12h **PLUS** Metronidazole 500mg IV q8h	Gentamicin 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 1.5gm IV q8h for 1 week	Amoxycillin/Clavulanate 1.2g IV q8h **OR** Ampicillin/Sulbactam 1.5g IV q8h for 1 week	
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 2014

11. NEUROLOGICAL SURGERY

Classification of Types of Neurosurgical Procedures According to the Risk of Infection

Category	Definition	Examples
Clean	No identifiable risk factors present; diagnoses by exclusion of all other categories	Ideal operation conditions, closed suction bellow drainage not exceeding 24 hours
Clean with implants	Either a temporary or permanent implants	Shunt surgery, intracranial pressure monitors, ventricular drains, arylic cranioplasties.
Clean contaminated	Risk of contamination of operative site during surgery	Entry into paranasal air sinuses, transphenoidal or transoral procedures, prolonged surgery, breaches in surgical technique
Contaminated	Contamination is known to have occurred	Compound skull fractures, open scalp lacerations, cerebrospinal fluid fistulae, subsequent operations(early)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Dirty	Established sepsis at the time of surgery	Brain abscess, subdural or parafalcine empyema, osteitis, ventriculitis,meningitis, purulent skin infections	
Clean (Craniotomy, burrhole for clean pathology) < 4 hours > 4 hours	Cefuroxime 1.5gm IV single dose one hour prior to skin incision Cefuroxime 1.5gm IV one hour prior to skin incision, followed by repeat dose 750mg IV q8h till completion of surgery	Ceftriaxone 2gm IV single dose one hour prior to skin incision Ceftriaxone 2gm IV one hour prior to skin incision, followed by repeat dose 1gm IV q12h till completion of surgery **β-Lactam Allergy**: Clindamycin 900mg IV **MRSA colonisation**: Vancomycin 15mg/kg IV	Am J Health-Syst Pharm Vol 70 Feb 1, 2013 Scottish Intercollegiate Guidelines Network. Antibiotic prophylaxis in surgery. www.sign.ac.uk/pdf/sign104.pdf (accessed Nov 2014) Nottingham Antibiotic Guidelines Committee, January 2014 National Institute for Health and Clinical Excellence. Surgical site infection (clinical guideline 74) 2008. www.nice.org.uk/CG74 (accessed Nov 2014).
Clean + Implant (CSF diversion procedures e.g. Shunt, EVD, omaya, DBS, Titanium/acrylic craniplasty, artificial dura used)	Cefuroxime 1.5gm IV single dose one hour prior to skin incision	Ceftriaxone 2gm IV single dose one hour prior to skin incision **β-Lactam Allergy**: Clindamycin 900mg IV **MRSA colonisation**: Vancomycin 15mg/kg IV	
Clean contaminated (Transphenoidal, Acosutic neuroma, involving air sinuses)	Cefuroxime 1.5gm IV single dose one hour prior to skin incision, followed by three repeated doses of 750mg IV q8h	Ceftriaxone 2gm IV single dose one hour prior to skin incision followed by three repeated doses of 1gm IV q12h. **β-Lactam Allergy**: Clindamycin 900mg IV	IDSA 2014, Scottish Intercollegiate Guidelines Network. Antibiotic prophylaxis in surgery. www.sign.ac.uk/pdf/sign104.pdf (accessed 2009 Jul 30)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		MRSA colonisation: Vancomycin 15mg/kg IV	UK University Hospital Guideline, January 2014 National Institute for Health and Clinical Excellence. Surgical site infection (clinical guideline 74) 2008. www.nice.org.uk/CG74 (accessed 2012 Dec 9).
Contaminated (Skull fracture, previous surgery, lacerated scalp)	Cefuroxime 1.5gm IV q8h **PLUS/MINUS** Metronidazole 500mg IV q8h for 72 hours	Ceftriaxone 2gmIV q12h **PLUS/MINUS** Metronidazole 500mg IV q8h for 72 hours **β-Lactam Allergy**: Clindamycin 900mg IV **MRSA colonisation**: Vancomycin 15mg/kg IV	
Dirty (brain abscess, subdural empyema, ventriculitis)	Ceftriaxone 2gm IV q12h **PLUS/MINUS** Metronidazole 500mg IV q8h For 6-8 weeks depending on response.	Meropenem 2gm IV q8h **PLUS/MINUS** Metronidazole 500mg IV q8h **MRSA colonization**: Vancomycin 20mg/kg IV **Pseudomonas infection**: Cefepime 2g IV q8h **OR** Ceftazidime 2g IV q8h	Reference: Tunkel, et al. Practice Guidelines for the Management of Bacterial Meningitis. Clin Inf Dis 2004; 39:1267-84.
12. CARDIAC SURGERY			
Cardiac surgery	Cefazolin 1gm IV (body weight < 60kg) **OR** Cefazolin 2gm IV(body weight > 60kg) Administer within 60 minutes of the skin incision.	Vancomycin IV 15mg/kg or 1 – 1.5gm Administered intravenously slowly over 1 hour, with completion within 1 hours of skin incision. Second dose of 7.5mg/kg may be considered during cardiopulmonary bypass, although its usefulness is not	The practice of continuing prophylactic antibiotics until surgical drains have been removed is of unproven benefits and is not advised.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Second dose of 1g should be administered every 3-4 hours.	well established. **PLUS** Gentamicin 4mg/kg IV Administered within 1 hour of skin incision Redosing an aminoglycoside during cardiopulmonary bypass is not indicated and may be harmful.	Single dose antibiotic prophylaxis may be effective in cardiac surgery, but there are inconclusive data to confirm this effectiveness. Single-dose prophylaxis is used in circumstances the surgeon considers optiomal for patient care. Antibiotic prophylaxis of 48hours duration is clinically effective in minimizing infectious complications in cardiac surgery. Postoperative prophylactic antibiotics are given for 48hours or less Reference : Ann Thorac Surg 2006;81:397–404 Ann Thorac Surg 2007;83:1569–76
13. OPHTHALMOLOGY			
The 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			

NON-SURGICAL

Maintenance of optimal oral health and hygiene is essential to reduce the incidence of bacteraemia from daily activity. Infective endocarditis prophylaxis for dental procedures is indicated for the following cardiac conditions:

- Prosthetic heart valves, including bio prosthetic and homograft valves
- Prosthetic material used for cardiac valve repair
- A prior history of IE
- Following congenital heart disease
- Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits
- Completely repaired congenital heart defects with prosthetic material or device, whether placed by surgery or by catheter intervention, during the 6 months after the procedure
- Repaired congenital heart disease with residual defects at the site or adjacent to the site of the prosthetic device (which inhibit endothelisation)
- Cardiac "valvulopathy" in a transplanted heart. Valvulopathy is defined as documentation of substantial leaflet pathology and regurgitation

Dental Procedures for which Prophylaxis is recommended

All dental procedures involve manipulation of gingival tissue or the periapical region of teeth or perforation of gingival mucosa:

- Dental Extraction
- Periodontal procedure including surgery, scaling and root planning, probing and recall maintenance
- Dental implant placement and re-implantation of avulsed teeth
- Endodontic (root canal) instrumentation or surgery only beyond the apex
- Sub gingival placement of antibiotic fibres or strips
- Prophylactic cleaning of teeth prior to implant where bleeding is anticipated

Other Procedures for which Prophylaxis is recommended

Antibiotic prophylaxis may be given to high risk patients who undergo invasive procedure of the respiratory tract that involves incision or biopsy of respiratory mucosa (level II A):

- Tonsillectomy and/or adenoidectomy
- Surgical operations that involve respiratory mucosa

For patients undergoing procedure to treat the infection e.g. drainage of empyema, antibiotic regime used to treat must be directed towards *Streptococcus viridans* as well as S*taphylococcus aureus*.

The AHA guidelines 2008 no longer consider any gastrointestinal and genito-urinary procedures high risk and therefore do not recommend routine use of IE prophylaxis even in patients with the highest risk cardiac conditions defined above.

For patients with established infections of the gastrointestinal and genito-urinary tract that have on-going enterococcal bacteraemia or who are undergoing genito-urinary procedure, antibiotic prophylaxis is recommended (an agent active against enterococci).

For high risk cardiac patients who undergo surgical procedures that involve the infected skin, skin structure, and musculoskeletal tissue antibiotic treatment against *Streptococcus viridans* and Staphylococcus is recommended.

Patients listed in who undergo an invasive respiratory tract procedure to treat an established infection, e.g. drainage of an abscess, should receive an antibiotic regimen which contains an anti-staphylococcal penicillin or cephalosporin. Vancomycin should be given to patients unable to tolerate

a β-lactam. Vancomycin or another suitable agent should be administered if the infection is known or suspected to be caused by a methicillin-resistant strain of *S. aureus* (MRSA)

In the case of an established infection or if antibiotic therapy is indicated to prevent wound infection or sepsis associated with a gastrointestinal or genitourinary tract procedure in patients, it is reasonable that the antibiotic regimen includes an agent active against enterococci, e.g. ampicillin, amoxicillin, or vancomycin. Vancomycin should only be administered to patients unable to tolerate β-lactams. If infection is caused by a known or suspected strain of resistant enterococcus, consultation with an infectious diseases specialist is recommended

For patients undergoing surgical procedures involving infected skin (including oral abscesses), skin structure, or musculoskeletal tissue, it is reasonable that the therapeutic regimen contains an agent active against staphylococci and b-haemolytic streptococci, e.g. an anti-staphylococcal penicillin or cephalosporin. Vancomycin or clindamycin may be used in patients unable to tolerate a β-lactam antibiotic. If the infection is known or suspected to be caused by MRSA, vancomycin or another suitable agent should be administered

(ESC guidelines on prevention of infective endocarditis 2009)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Prophylactic Regimens for Dental, Oral, Respiratory Tract, Skin and Musculoskeletal Tissue			
Prophylactic Regimes for Dental, Oral, Respiratory Tract, Skin and Musculoskeletal Tissue	Amoxycillin/Clavulanate 2gm PO single dose 1 hour before procedure	Ampicillin 2gm IV single dose 30 minutes before procedure **OR** Cefazolin 1gm IV single dose 30 minutes before procedure **OR** Ceftriaxone 1gm IV single dose 30 minutes before procedure **OR** Clindamycin 600mg PO single dose 1 hour before procedure **OR** 600mg IV single dose 30 minutes before procedure	If patient is unable to tolerate PO antibiotic If patient is unable to tolerate PO antibiotic or allergic to penicillin If patient is unable to tolerate PO antibiotic or allergic to penicillin) If patient has immediate-type penicillin hypersensitivity)
Secondary Prevention of Rheumatic Fever			
Secondary Prevention of Rheumatic Fever	Penicilin G Benzathine (Benzathine Penicillin)1.2MU IM every 3 weeks	Penicillin V 250mg PO q12h **OR** Erythromycin Ethylsuccinate 800mg PO q12h	

Type of Infection	Duration of treatment
Rheumatic fever with carditis and residual heart disease (persistent valvular disease)	10 years or until 40 years of age, whichever is longer; sometimes lifelong prophylaxis
Rheumatic fever with carditis but no residual heart disease (no valvular disease)	10 years or until 21 years of age, whichever is longer
Rheumatic fever without carditis	5 years or until 21 years of age, whichever is longer

The Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (2nd edition)

GASTROINTESTINAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Oropharyngeal Candidiasis			
Mild Moderate to severe	Nystatin 400 000-600 000 PO q6h for 7-14 days **OR** Fluconazole 100-200mg PO q24h for 7-14 days	Itraconazole 200mg PO q24h for 7-14 days	- Prophylaxis with underlying risk factor:- steroid therapy/ chemo therapy/ radiation induced xerostomia; Fluconazole 100mg PO q24h - In head & neck cancer patient with drug-resistant *candida* (eg-galbrata, krusei) to consider Voriconazole 200mg PO q12h **OR** * Posaconazole 200mg PO q8h * Requires DG approval
Esophagitis			
Candida	Fluconazole 200-400mg PO q24h for 14-21 days	Itraconazole 200mg PO q24h for 14-21 days	For patient non responsive to Fluconazole to consider Voriconazole 200mg q12h
Herpes simplex virus Immunocompetent host Immunocompromised host	Acyclovir 200mg PO 5 times/day for 7-10 days **OR** Acyclovir 400mg PO q8h for 7-10 days Acyclovir 400mg PO q8h for 14-21 days		- For patient with severe or odynophagia duration of treatment for Acyclovir IV 5mg/kg q8h for 7-14 days. -Duration of therapy represents total time 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)
Cytomegalovirus Immunocompetent host	Ganciclovir 5mg/kg IV q12h for 3-6 weeks		
Helicobactor Pylori			
Established indications for testing for *H.pylori* and treating positive patients:-	*Proton Pump Inhibitors(PPI) e.g.Omeprazole,Pantoprazole, Lansoprazole,Rabeprazole,	**Recurrence of *H.pylori* disease)** *Proton Pump Inhibitors (PPI) PO q12h for 10-14 days	- First choice therapy recommended in areas with <15-20% Clarithromycin resistance.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
- Active PUD-gastric or duodenal - Confirmed history of PUD (not previously treated for *H.pylori*) -Gastric MALT lymphoma (low grade) -Following resection of gastric cancer -Family history of gastric cancer in a 1st degree relatively -Atropic gastritis -Other indications (nonulcer dyspepsia, long term PPI use, person using NSAID/ASA, unexplained iron deficiency anemia, family members of patients with *H.pylori* with mild dyspepsia)	Esomeprazole PO q12h for 10-14 days **PLUS** Clarithromycin 500mg PO q12h for 10-14 days **PLUS** Amoxycillin 1g PO q12h for 10-14days **<u>Penicillin Allergy</u>** Proton Pump Inhibitors (PPI) PO q12h for 10-14 days **PLUS** Clarithromycin 500mg PO q12h for 10-14 days **PLUS** Metronidazole 400mg PO q12h for 10-14 days	**PLUS** Tetracycline 500mg PO q6h for10-14 days **PLUS** Metronidazole 400mg PO q8h for 10-14 days **PLUS** Bismuth Subcitrate 420mg PO q6h for 10-14 days	- * Dosages of PPI:- Omeprazole 20mg q12h Pantoprazole 40mg q12h Lansoprazole 30mg q12h Esomeprazole 20mg q12h Rabeprazole 20mg q12h

Infectious Diarrhoea

- Most infectious diarrhea is self-limited and only requires supportive management
-Treatment with antibiotics is not recommended for mild-moderate disease.
-Treatment recommended for:-
  - severe illness
  - age <6/12 or >50 years
  - gross blood in stool
  - high grade fever >38°C
  - worsening or relapse/persistent of symptoms >1 week
  - immunocompromised host
  - excessive bowel movement >8 times a day

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Shiga toxin producing *E.coli* (STEC), *Klebsiella oxytoca*, *Aeromonas/Plesiomonas* *Yersinia* species	Ciprofloxacin 500mg PO q12h for 3-5 days	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3-5 days	- Viral pathogens such as Norovirus and rotavirus commonly cause diarrhea and do not require antibiotics. - Multiple stool examination for ova and parasites (O&P) are of low yield.
Campylobacter jejuni	Azithromycin 500mg PO q24h for 3 days		
Salmonella, non-typhi Not routinely required treatment Treatment recommended for: Patient <6mo or >50 yo Severe illness requiring hospitalisation, prostheses, valvular heart disease, severe atherosclerosis or bacteremia, malignancy or immunocompromise	Ciprofloxacin 500mg PO q12h	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h (if susceptible) **OR** Ceftriaxone IV 1g q24h **OR** Azithromycin 500mg PO q24h	- Immunocompetent Host: Duration of treatment: 5-7 days -Immunocompromise Host: Duration of treatment :14 days or longer if relapsing
Vibrio cholera	Primary therapy is rehydration. Select antibiotics based on susceptibility of locally prevailing isolates. Azithromycin 1g PO single dose **OR** Doxycycline 300 mg PO single dose	Erythromycin Ethylsuccinate 800mg PO q12h for 3 days **OR** Tetracycline 500 mg q6h for 3 days	Pregnant : recommended Azithromycin
Shigella sp. (Fever and bloody stool)	Ciprofloxacin 750mg PO q12hr for 3 days	Azithromycin 500mg PO q24h for 3 days	-In immunocompromised patients duration of antibiotic 7-10 days.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		OR Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3 days	- For severe disease, ceftriaxone 50-75mg/kg per day x 2-5 days
Giardia	Metronidazole 250–750mg q8h for 7–10 days		
Isospora species	Trimethoprim/Sulfamethoxazole 160 and 800 mg PO q12h for 7-10 days		
Cyclospora species	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 7 days		
Entamoeba histolytica	Metronidazole 750 mg PO q8h for 5–10 days		
Clostridium difficile Initial, mild or moderate Initial, severe Initial, severe, complicated First recurrence Second recurrence	 Metronidazole 500mg PO q8h for 10-14 days Vancomycin 125mg PO q6h for 10-14 days Vancomycin 500mg PO q6h **PLUS** Metronidazole 500mg IV q8h for 10-14 days Same as for initial episode Tapering and pulsed oral Vancomycin 125mg PO q6h for 7-14 days then 125mg PO q12h for 7 days then 125mg PO q24 for 7 days then 125mg PO every other day for 7 days then		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	125mg PO every 3 days for 14 days		
Travellers Diarrhea			
Self medication, patient usually afebrile	Ciprofloxacin 500mg PO q12 for 1-3 days	Azithromycin 1gm PO single dose	
Liver Abscess			
Pyogenic liver abscess *Enterobacteriaceae* (esp. *Klebsiella* sp.), *bacteroides*, enterococci, *Entamoeba histolytica,* *Yersinia enterocolitica* (rare), *Fusobacterium necrophorum (*Lemierre's*).*	Metronidazole 500mg IV q8h **PLUS** Ceftriaxone 1-2gm IV q24h **OR** Ampicillin/Sulbactam 3gm IV q6h	Piperacillin/tazobactam 4.5gm IV q6h **OR** Ciprofloxacin 400mg q12h 14 days	Duration : 4-6 weeks -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 -Serological tests for amebiasis should be done on all patients; - Carbapenem Group is recommend for Diabetes Mellitus patient due to risk of ESBL infection - Most patients on IV therapy may switch to PO when clinical improvement
Amoebic liver abscess *Entamoeba histolytica*	Metronidazole 500mg PO q6h or 15mg/kg IV q12h (max4g/day) for10 days		-May switch to PO when clinical improvement occurs
Cholecystitis and Cholangitis			
Enterobacteriaceae, enterococci,*bacteroides,* *Clostridium* sp, rarely *candida*	Ampicillin/Sulbactam 3gm IV q6h	*3rd gen. Cephalosporins* **PLUS** Metronidazole IV 1gm loading then 500mg q6h **Severe Penicillin Allergy :**	-several ill patients with cholangitis and complicated cholecystitis,adequate biliary drainage is crucial as antibiotics will not enter bile in the presence of obstruction

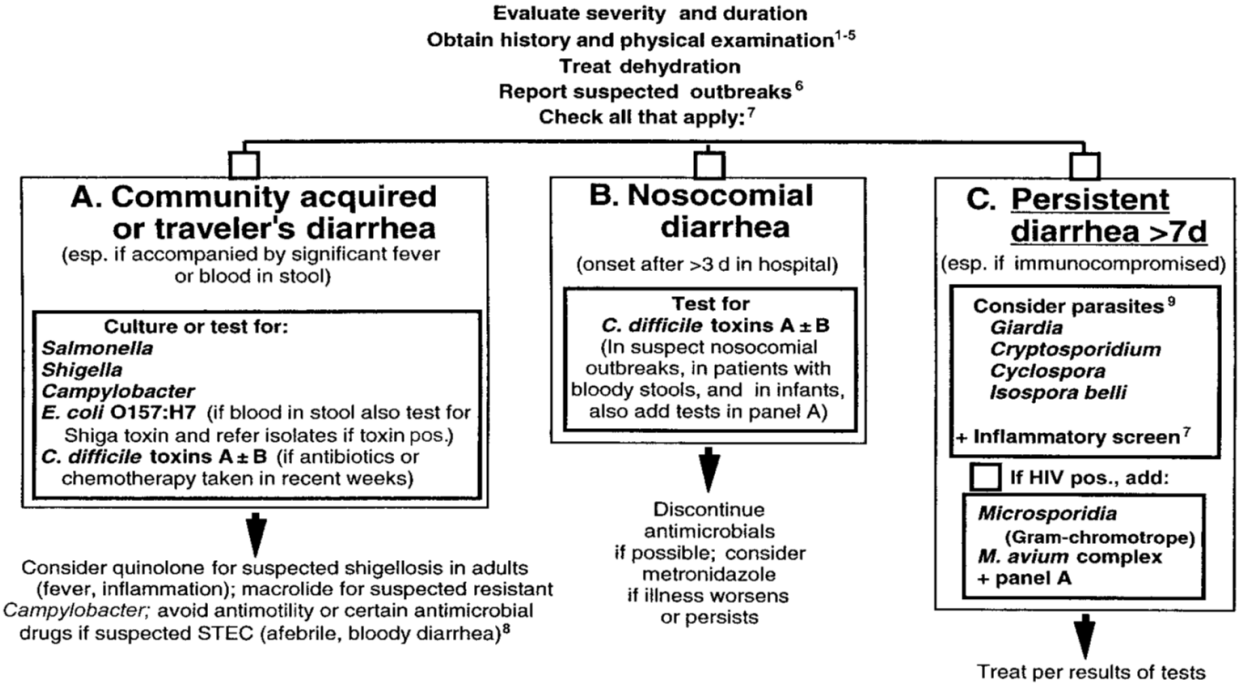
Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		Ciprofloxacin 400mg IV q12h **PLUS** Metronidazole 500mg IV q8h	-Uncomplicated cholecystitis treat only until obstruction is relieved. No post-procedure antibiotics are necessary if the obstruction is succecssfully relieved -Complicated cholecytitis:4-7 days, Unless adequate source control is not achived. -Biliary sepsis; 4-7 days. Unless adequate source control is not achived -In cases of uncomplicated acute choleycytis,antibiotics should be given until the biliary obstruction is relieved(either by surgery,ERCP or percutaneous drain)
Spontaneous bacterial peritonitis (SBP)			
Primary SBP *Enterobacteriacea, esp E. coli and K. pneumoniae, S. pneumo, enterococci,*)	Cefotaxime 2gm IV q8h (if life-threatening, q4h) for 5 days	Ceftriaxone 2gm IV q24h for 5 days	- Suggest 2 weeks if blood culture positive. - Suggests repeat paracentesis after 48 hrs of cefotaxime. If PMNs <250/mm3 &ascitic fluid sterile, success with 5 days of treatment
Prophylaxis against SBP - all patients with cirrhosis and UGIB should receive prophylaxis for 7 days (50% develop SBP after bleed) -patients who get SBP should get lifelong prophylaxis to prevent future episodes (40-70% risk of recurrence in 1 year)	**Cirrhotic patients with UGIB** Ciprofloxacin 400mg IV q12h for 7 days **Non-bleeding cirrhotic patients with ascites** Trimethoprim/Sulfamethoxazole 160/800mg PO daily for 7 days **Lifelong prophylaxis**	Ceftriaxone 1 gm IV q24h for maximum of 7 days	- IV Ceftriaxone only can be used if patient cannot tolerate orally

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Trimethoprim/Sulfamethoxazole 160/800mg PO for 5 days/wk **OR** Ciprofloxacin 750mg PO per week		
Acute Pancreatitis ▪ Mild to moderate pancreatitis- no antibiotic ▪ Severe acute pancreatitis -no prophylactic antibiotics ▪ Definition is associated with one or more of the following:1) > 30% pancreatic necrosis 2) more than 3 Ranson`s criteria 3) APACHE 11 >8 ▪ No necrosis – no antibiotic ▪ Sterile pancreatic necrosis –no antibiotic			
Infected pancreatic necrosis Definition : is defined as one or both of the below 1)CT scan with gas 2) percutaneous aspiration / surgical specimen with organism evident on gram stain / C&S	Piperacillin/Tazobactam 4.5gm IV q8h	Ciprofloxacin 400mg IV q12h **PLUS** Metronidazole 500 mg IV q8h **OR** Imipenem 500mg IV q6h **OR** Meropenem 1gm IV q8h	
Diverticular disease			
Polymicrobial **Aerobic organism** usually *E.coli, Klebsiella pneumoniae, Enterobacter* spp, *Enterococcus* spp *and Proteus* spp **Anaerobic organism**	**Mild to moderate** Amoxycillin/Clavulanate 625mg PO q8h for 4-7 days **OR** Ampicillin/Sulbactam 3gm IV q6h	**Non severe Penicillin Allergy:** Cefepime 1gm IV q8h **PLUS** Metronidazole 500mg IV q8h for 4-7 days **Severe Penicillin Allergy:** Cipropfloxacin 400mg IV q12h	Duration can be longer if adequate source control is not obtained.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
B. fragilis, Prevotella spp and *Peptostreptococcus* spp.	**Severe infection/ life threatening disease** Piperacillin/Tazocin 4.5gm IV q6h for 4-7 days **OR** Imipenem 500mg IV q6h **OR** Meropenem 1gm IV q8h **Outpatient treatment** **Mild diverticulitis** Trimethoprim/Sulfamethoxazole 320/1600mg PO q12h **OR** Ciprofloxacin 750mg PO q12h **PLUS** Metronidazole 500mg PO q6h for 7-10 days	**OR** Ciprofloxacin 500mg PO q12h **PLUS** Metronidazole 400mg IV/PO q8h for 4-7 days	
Hepatosplenic candidiasis			
Candida spp.	**<u>Stable patients</u>** Fluconazole 400mg (6mg/kg) IV q24h **<u>Severely ill patients</u>** Amphotericin B 0.5–0.7mg/kg IV q24h After patient is stable,change to Fluconazole 400mg PO q24h	Caspofungin 70mg stat than 50mg q24h **OR** Anidulafungin 200mg IV loading then 100 mg IV q24h followed by Fluconazole 400 mg IV/PO q24h	Durationof therapy is until lesions have resolved (usually months) and should continue through periods of immunosuppression (e.g. chemotherapy and transplantation).

References:
1. IDSA Guideline for Intrabdominal infection ; Clin Infect Dis 2010:50; 133-164

2. IDSA guideline on Management of candidiasis
3. Clinical Practice Guidelines for Clostridium difficile Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) , Infect Control Hosp Epidemiol 2010; 31(5):431-455
4. Practice Guidelines for the Management of Infectious Diarrhea, IDSA GUIDELINES ,CID 2001:32
5. Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America; Complicated Intra-abdominal Infection Guidelines ; CID 2010:50 (15 January)



Recommendations for the diagnosis and management of diarrheal illnesses

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	Systemic antibiotic use not recommended	Antibiotics and The Treatment of Endodontic Infections *Endodontics colleagues for Excellence 2006; American Association of Endodontics*
Localised Dentoalveolar Abscess	Systemic antibiotic use not recommended If patient medically compromised besides local treatment can consider : Amoxycillin 500mg PO q8h	Systemic antibiotic use not recommended **Penicillin Allergy:** Clindamycin 150-300mg PO q6h	Incision and Drainage and Management of Cause of Abscess and Symptomatic Relief of Pain *JCan Dent Assoc* 2003 Nov 69 (10):660 Clin.Microbiol.Rev.2013,26(2):255
Dry Socket	Systemic antibiotic use not recommended	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 in absence of regional or systemic signs and symptoms	Systemic antibiotic use not recommended in absence of regional or systemic signs and symptoms	Local treatment with antiseptic irrigation and mouthwash and symptomatic relief of pain *JClinMicrobiol.*2003;41(12):5794-7 *Journal of the Irish Dental Association* 2009; 55 (4): 190 – 192
Chronic Gingivitis	Systemic antibiotic use not recommended	Systemic antibiotic use not recommended	1st line treatment-Mechanical and chemical plaque control . *0.2% Aqueous Chlorhexidine Gluconate not be used alone but as an adjunct to mechanical debridement

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
			Clinical Periodontology-12th ed.2014 2nd line treatment-Antimicrobial mouthrinse *Clinical Periodontology-9th ed.2002*
Chronic Periodontitis	Systemic antibiotic use generally not recommended. Can be considered in cases of: 1. Unresponsive to conventional 2. Episodes of acute infection 3. Medically compromised patientstherapy	Systemic antibiotic use generally not recommended.	1st line treatment-Mechanical plaque control *Periodontology 2000, Vol. 62, 2013, 218-231* CPG Management of chronic periodontitis Nov 2012 MOH,Malaysia
Aggressive Periodontitis *A. actinomycetemcomitans, P. gingivalis, Tannerella forsythensis, P. intermedia, Spirochaetes*	Amoxycillin 500mg PO q8h **PLUS** Metronidazole 400mg PO q8h	Azithromycin 500mg q24h for 3 days	Antibiotics are not used alone but are used as an adjunct to scaling and root debridement *JClin Periodontol*.2012;39:284-294 *Clin Periodontol*.2011;38:43-49 J Clin Periodontol 2008; 35: 696–704 J Periodont Res 2012; 47: 137–148
Local missed Periodontal Abscess	Systemic antibiotic use not recommended	Systemic antibiotic use not recommended	Incision and Drainage and management of cause of abscess and symptomatic relief of pain Periodontology 2000. Jun2014, Vol. 65 Issue 1, p149-177. 29p. Malaysian Dental Journal (2008) 29(2) 154-157 *CPG=Managementofperiodontal abscess-MOH,Malaysia* 2003
B. Infections of the Jaws			
Osteomyelitis of the jaws of dental origin Different organisms maybe involved	For **acute cases**,start with: Phenoxymethylpenicillin 250-500mg PO q6h* **OR** **Benzylpenicillin 1-2MU IV q6h	**Clindamycin150-300mg 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 **Duration of antibiotic therapy can

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
			be 4-6 weeks depending on patient response / microbiological clearance of the pathogen
C. Spreading Infections and Infections of Fascial Spaces (with/without Systemic Signs)			
Cellulitis±Abscess of dental origin Viridans Streptococci, *Staphylococci, Prevotella, Peptostreptococcus Fusobacterium nucleatum Clostridium* sp Surgical site infection & Traumatic wound infection (Infection is usually by endogenous organisms rather than exogenous) Viridans Streptococci *Staphylococci* *Prevotella, Peptostreptococcus, Eubacterium,and Fusobacterium*	Benzylpenicillin 2-4MU IV stat then 1-2MU IV q4-6h **PLUS/MINUS** Metronidazole 500mg IV q8h (or 1g q12h) **OR** Amoxycillin/Clavulanate 1.2gm IV q6-8h (not more than1.2gm in a single dose- max 7.2gm daily) **OR** Cefuroxime 750mg-1.5gm IV q8h **PLUS/MINUS** Metronidazole 500mg IV q8h(or 1gm q12h)* **OR** If not responding to above antibiotics, Ceftriaxone 1-2gm IV q24h (maybe given up to 4gm per day)	**Penicilin Allergy:** Clindamycin150-450mg IV q6h <u>Oral administration</u>: Amoxycillin 250-750mg PO q8h **PLUS/MINUS** Metronidazole 400mg PO q8-12h **OR** Amoxycillin/Clavulanate 625mg PO q8h. **OR** Cefuroxime 250-500mg PO q12h **OR** Clindamycin 150-450mg PO q6h	Empirical antibiotics are started Incision and drainange is advised and antibiotics is changed in accordance with result of culture and sensitivity
Traumatic wound involving skin / Infection of skin origin	Cloxacillin 500mg-1gm IV q6h (inskin involvement- if *Staph*. expected) **OR** Clindamycin 150-450mg IV q6h		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Oral administration: Amoxycillin 250-750mg PO q8h **PLUS/MINUS** Metronidazole 400mg PO q8-12h **OR** Clindamycin 150-450mg PO q6h		
D. Post Implant Infections ("Periimplantitis")			
Causative Organisms: *Actinomyces* sp. *Eubacterium* sp. *Propionibacterium* sp. *Lactobacillus* sp. *Veillonella* sp. *P. gingivalis* *Prevotella intermedia* *F. nucleatum*	Amoxycillin/ Clavulanate 625mg PO q8h **OR** Amoxycillin 500mg PO q8h **PLUS** Metronidazole 400mg PO q8h	**Penicillin Allergy:** Doxycycline100mg 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. Locally delivered antibiotics is preferred compared to systemic administration Currently there is no reliable study to suggest most effective antibiotic therapy. Eur J Oral Implantol 2012; 5 (Suppl): S21-S41 Clin Oral Impl Res 2012 (23): 205-210 Int.J Oral Maxillofac Implants 2014 (29): 325-345 Maintenance system -CIST protocol Clin Oral Impl Res 2000:11(suppl): 146-155

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
2. ANTIMICROBIAL USE FOR FUNGAL INFECTIONS			
A. Oral Candidiasis			
Acute Pseudomembranous Candidiasis Hyperplastic Candidiasis (Candidal Leukoplakia)	Topical antifungal Nystatin (oral suspension) 500,000-1,000,000U 6-8h /day (to continue for 2 days after perioral symptoms disappeared or cultures show eradication of *candida* sp.) Systemic antifungal for severe infections,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		Am Fam Physician. 2008;78(&):845-852 Journal of Oral Microbiology 2011,3:5771-DOI: 10.3402/jom.v3i0.5771 Med Oral Patol Oral Cir Bucal. 2011 Mar 1:16(2):el 39-43 Australia Dental Journal 2010; 55:(1 suppl):48
Chronic Erythematous Candidosis (*candida*-associated denture stomatitis with and without angular chelitis)	Local measures- denture cleansers, remove dentures at night Soak dentures in Chlorhexidine mouthwash 2% Topical antifungals if local measures fail -Nystatin (oral suspension) 500,000-1,000,000U q6h-8h		Am Fam Physician. 2008;78(&):845-852 Journal of Oral Microbiology 2011,3:5771-DOI: 10.3402/jom.v3i0.5771 Med Oral Patol Oral Cir Bucal. 2011 Mar 1:16(2):el 39-43 Australia Dental Journal 2010; 55:(1 suppl):48-54

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	(to continue for 2 days after perioral symptoms disappeared or cultures show eradication of candida sp.)		
3. ANTIMICROBIAL USE FOR VIRAL INFECTIONS			
Common oral viral infections: Herpes simplex virus type 1 (HSV-1) -Primary herpetic gingivostomatitis -Herpes labialis Herpes simplex virus type 2 (HSV-2) Epstein-Barr virus Eg : Infectious mononucleosis, oral hairy leukoplakia Varicella-zoster virus Coxsackie virus -Herpangina -Hand, foot and mouth disease	**Symptomatic treatment in most cases**. Can also consider: 1)**Topical Acyclovir** 5% cream q4h for 5-10 days in prodromal phase for recurrent herpes labialis 2) **Systemic antiviral** Acyclovir 400-800mg PO 5 times daily for 7-14 days **OR** Acyclovir 5mg/kg IV q8h for 5 days for severe infection or immunocompromised patients **OR** Acyclovir 10mg/kg IV q8h for 10-21 days for varicella zoster in immunocompromised and simplex encephalitis		Aust Dent J 2005;50 Suppl 2: S31-S35

OBSTETRICS & GYNEACOLOGICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Septic Abortion	Ampicillin/Sulbactam 3gm IV q6h **PLUS** Doxycycline 100mg PO q12h	Ampicillin 2gm IV q4h **PLUS** Gentamicin 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h	Intravenous antibiotics are administered until the patient has improved and been afebrile for 48 hours, then are typically followed by oral antibiotics to complete a 10- to 14-day course.
Intrapartum prophylaxis for Group B *Strep*., positive mothers	Penicillin G 5MU IV initial dose, then 2.5 – 3MU IV q4h until delivery.	Ampicillin 2gm IV initial dose, then 1gm IV q4h until delivery. **OR** Vancomycin 1gm IV q12h until delivery **Penicilin Allergy:** If "low risk" for anaphylaxis: eg, isolated maculopapular rash without urticaria or pruritus: Cefazolin 2gm IV initial dose, then 1gm q8h until delivery. If life threatening (anaphylactic): Erythromycin Lactobionate 500mg IV q6h **OR** Clindamycin 900mg IV q8h (if susceptible)	Prophylaxis is begun at hospital admission for labor or rupture of membranes and continued every four hours until the infant is delivered.
Preterm Premature Rupture of Membranes (PPROM)	Ampicillin 2gm IV q6h for 48 hours, followed by Amoxicillin 500mg PO q8h for an additional 5 days.	**Penicilin Allergy:** If "low risk" for anaphylaxis: eg, isolated maculopapular rash without urticaria or pruritus:	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	PLUS One dose of Azithromycin 1gm PO upon admission	Cefazolin 1gm IV q8h for 48 hours then Cephalexin 500mg PO q6h for 5 days **PLUS** One dose of Azithromycin 1gm PO **If life threatening** (anaphylactic): Clindamycin 900mg IV q8h **PLUS** Gentamicin 5-7mg/kg* IV for q24h for 48 hours, followed by Clindamycin 300mg PO for 5 days. **PLUS** One dose of Azithromycin 1gm PO	*For Gentamicin, in underweight and nonobese patients, use of total body weight instead of ideal body weight for determining the dose mg/kg.
Chorioamnionitis	Ampicillin 2gm IV q6h **PLUS** Gentamicin 5mg/kg* IV q24h If the patient is undergoing a cesarean delivery: **PLUS** Metronidazole 500mg IV q8h **OR** Clindamycin 900mg IV q8h	Ampicillin/Sulbactam 3gm IV q6h	*For Gentamicin, in underweight and nonobese patients, use of total body weight instead of ideal body weight for determining the dose mg/kg. Routine monitoring of gentamicin levels is not indicated for the otherwise healthy woman. If clinical improvement noted with intravenous therapy no oral therapy required.
Pelvic Inflammatory Disease			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
IV Therapy (for moderate to severe disease): Outpatient therapy (for mild disease)	Cefuroxime 1.5gm IV q8h **OR** Ceftriaxone 2gm IV q24h **PLUS** Doxycycline 100mg PO q12h **PLUS** Metronidazole 500mg IV/PO q8h Duration of treatment is 14 days Ceftriaxone 250mg IM in a single dose **OR** Cefotaxime 1gm IM in a single dose **PLUS** Doxycycline 100 mg PO q12h for 14 days	Ampicillin/Sulbactam 3gm IV q6h **PLUS** Doxycycline100mg PO q12h Ceftriaxone 250mg IM in a single dose **OR** Cefotaxime 1gm IM in a single dose **PLUS** Azithromycin (1gm once per week for 2 weeks)	
Vaginitis Bacterial vaginosis	Metronidazole 400mg PO q8h for 7 days	Clindamycin 300mg PO q12h for 7 days	Meta-analysis has not found any relationship between metronidazole exposure during the first trimester of pregnancy and birth defects and the CDC no longer discourage the use of metronidazole in the first trimester.
Candidiasis Uncomplicated infection *Candida albicans*	Clotrimazole 500mg as a single vaginal pessary (Stat dose) **OR**	Fluconazole 150mg PO for one dose	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Complicated infection 1. Severe vaginitis symptoms 2. Recurrent vulvovaginal candidiasis	Clotrimazole 200mg as vaginal pessary for 3 nights Fluconazole 150mg PO q72h for 2 or 3 doses Fluconazole 150mg PO q72h for 3 doses then weekly for 6 months	Clotrimazole 500mg vaginal suppository once weekly for 6 months	
Trichomoniasis *Trichomonas vaginalis*	Metronidazole 2gm PO as single dose **OR** Metronidazole 400mg PO q8h for 7 days	**In Pregnancy:** Metronidazole 400mg PO q8h for 7 days	Patients should be advised to not consume alcohol for 24 hours after metronidazole treatment because of the possibility of a disulfiram-like (Antabuse effect) reaction. The CDC no longer discourages the use of metronidazole in the first trimester.
Acute Uncomplicated Cystitis	Refer to Urinary Tract Infections Section		
Recurrent Urinary Tract Infection	Refer to Urinary Tract Infections Section	**Postcoital prophylaxis** (a single postcoital dose) Trimethoprim/ Sulfamethoxazole 480mg PO as a single dose **OR** Ciprofloxacin 125mg PO as a single dose **During pregnancy:** Cephalexin 250mg PO as single dose	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		OR Nitrofurantoin 50mg PO as single dose	

INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

A. HAEMATOLOGY

1. Any infection in the immunocompromised host is life-threatening and needs immediate attention. Febrile neutropenia is defined as a temperature of >38.3^{O}C on a single occasion or >38^{O}C over one hour and ANC (Absolute Neutrophil Count) <500cells/uL or <1000cells/uL in those with anticipated declining counts.

2. Cultures maybe 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^{O}C or hypothermia. 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	Gram –ve organisms Gram +ve organisms Fungi
Hypogammaglobulinaemia Post splenectomy/ hyposplenic patients	Encapsulated organisms
Defective cellular immunity	Pneumocystis,Toxoplasma Fungi, Viruses Mycobacteria

4. The choice of antibiotic is based on local organisms and sensitivity patterns. This should be based on sound clinical judgment, the clinical state of the patient, prior infections with drug resistant bacteria, recent outbreaks e.g. MRSA or multi-drug resistant Enterobacteriaceae, as well as the availability and cost of the antibiotics. Surveillance for CRE, *Stenotrophomonas maltophilia* and multi-resistant organisms should be carried out by the infection control team of the respective hospitals. If this service is not available, the hospital should set up a local surveillance team to monitor these organisms. The incidence of these organisms must be borne in mind when selecting agents for use in the first line setting

5. Risk assessment for complication of severe infection should be done during triage. **Patient** are deemed high risk if there is prolonged and profound ANC< $0.1x10^{9}$/L, hypotension, pneumonia, new onset abdominal pain or neurological signs, and should be admitted to hospital for IV antibiotics.

6. The administration of the first dose of empirical anti-pseudomonal antibiotic should be done as soon as possible following triage (within the first hour) after taking blood cultures. The following regimens are suggested:

   a. **First lline therapy:** Piperacillin/Tazobactam 4.5gm IV q6h **OR** Cefepime 2gm IV q8h. Aminoglycosides e.g Gentamicin or Amikacin may be added in combination therapy prior knowing sesitivity results. Ceftazidime 2gm IV q8h can be used as an alternative. Duration: until neutrophils count recovers to > 500 /u or longer if clinically indicated (> 1 x 109/L)

   b. **Second line therapy:** Carbapenem; Imipenem 500mg IV q8h/q6h **OR** Meropenem 1gm q8h. Imipenem 1gm 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. Metronidazole 500mg

IV q8h may be added to cefipime in the presence of severe mucositis, intra abdominal infections, peri-anal abscesses or colitis. Piperacillin/Tazobactam and Carbapenems have good anaerobic coverage and therefore do not need additon of metronidazole.

e. **Glycopeptide therapy** e.g. Vancomycin is not recommended as a standard part of the initial antibiotic regimen. Vancomycin 15mg/kg IV q12h **OR** q8h may be added in suspected central device infections, known colonizers by MRSA, severe mucositis, sikin or soft tissue infection suspected MRSA/MRSE infections and severe sepsis, septic shock or respiratory distress. Consider stopping after 48 hr if no microbiological evidence of gram positive infection. Linezolid is an alternative in those patients with no clinical response to Vancomycin and in those with suspected or confirmed VRE, VISA or VRSA.

f. Consider adding **antifungal therapy** if fever persisted or evidence of new infection after 5 to 7 days of broad spectrum antibiotic therapy or earlier especially jn the presence of severe mucositis, oral thrush, painful swallowing, suspicious skin infiltrates or pulmonary infiltrates, fundal exudates or prolonged steroid/antibiotic use more than 2 weeks). Amphotericin B remains the empirical therapy of choice for invasive fungal infections. For patients who are intolerant, refractory or those with toxicity to conventional Amphotericin B, the lipid formulations of Amphotericin B, Voriconazole and Echinocandins are alternatives empirical therapy based on local availability and costs. Voriconazole is an alternative to Amphotericin B for preemptive and directed therapy for invasive aspergillosis. In candidiasis, echinocandins, azoles and ampho B are antifungals of choice.

Antifungal agent	Daily dose
Liposomal ampho B	3 mg/ kg
Caspofungin	Load 70mg followed by 50 mg
ABCD	4 mg/kg
ABLC	5 mg/kd
Itraconazole	200 mg bd
Ampho B deoxycholate	0.5-1 mg/kg
Fluconazole	400 mg
Voriconazole	6 mg/kg bd followed by 4 mg/kg bd
Posaconazole	600 mg

ABCD: amphotericin B colloidal dispersion ABLC: amphotericin B lipid complex

g. **The use of growth factors** e.g.G-CSF may be considered as prophylactic use. The prophylactic use of growth factors significantly reduced the relative risk for severe neutropenia, febrile neutropenia and infection. It should be considered in high-risk patients with ANC<100/uL multiple organ dysfunction syndrome, pneumonia, invasive fungal infections or septic shock. However, there is no evidence that either G-CSF reduced the number of patients requiring intravenous antibiotics or lowered infection related mortality.

h. **The role of granulocytes** remains controversial and should be discussed with haematologist. 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.

i. **The use of oral antibiotics with** Ciprofloxacin and amoxicillin / Clavulanate, may be considered after careful assessment of risk factors and a consult from the haematologist, in an outpatient setting for low risk patients (i.e no evidence of dehydration or hypotension, no evidence of pneumonia/COAD) and it is important that patients must be able to access prompt medical attention if condition deteriorates.

j. Prophylaxis **against bacterial, viral or fungal infections** is advised after bone marrow or haematopoietic stem cell transplantation or in high-risk patient after chemotherapy.

	Disease / therapy Examples	Antibacterial prophylaxis	Duration
Antibacterial	Autologous HSCT Allogenic HSCT	Ciprofloxain Penicillin V	Start at time of conditioning Until resolution of neutropenia or initiation antibacterial therapy for febrile neutropenia Post transplant until is continuation of immunosuppresion
Antifungal	AML CML in blast crisis Autologous HSCT Allogenic HSCT	Fluconazole	During neutropenia until resolution and achievement of complete remission Until resolution of neutropenia
Antiviral	Autologous HSCT Allogenic HSCT Bortezomib (only in myeloma patients) Purine Analog therapy (fludarabine / cladribine)	Acyclovir **OR** Valacyclovir	During 30 days after HSCT Until discontinuation of Bortezomib At least 3 months after discontinuation of purine analog
Anti PCJ therapy	Autologous HSCT Allogenic HSCT Purine Analog therapy	Co-trimoxazole	Start when achieved engraftment, continue until resolution of immunosuppression At least 3 months after discontinuation of purine analog

(HSCT: haematopoietic stem cell transplant)

k. Infections following haematopoietic stem cell transplant are generally similar to that in the solid organ transplant setting. In addition to the usual bacterial, fungal infections and viral infections especially CMV reactivation and parasitic infections e.g. *Pneumocystis jiroveci* (PCJ) and Toxoplasma infection can occur. It is recommended that prophylactic use of Ganciclovir or pre-emptive monitoring for CMV reactivation should be carried out during the first 100 days. Trimethoprim/ Sulphamethoxazole 480mg once daily or 960mg 3x/week is, also extremely effective in the prevention of PCJ 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 immunosuppressive agents.

1st line	Piperacillin/Tazobactam 4.5gm IV q6h OR Cefepime 2gm IV q8h	Aminoglycosides e.g. Gentamicin or Amikacin may be added in combination
2nd line	Imipenem 500mg IV q8h or q6h or 1gm q8h (severe sepsis) **OR** Meropenem 1gm q8h	Carbapenams are only indicated as first line therapy in seriously ill patient either presenting as septic shock, or with known previous infections with ESBL enterobacteriaceae or gram-negative organisms resistant to narrow spectrum B-lactams.
Glycopeptides	Vancomycin 15mg/kg IVq 12h or q8h	Colonization with MRSA or MR**S**E or suspicion of serious catheter related infections or skin and soft tissue infection. Linezolide (dose): alternative and in those suspected or infected with VRE/VISA/VRSA should be started on
Antifungal agents	Conventional Amphotericin B Liposomal Amphotericin B Echinocandins	Maybe added as empirical therapy from D5-7 Voriconazole is the preferable preemptive and directed therapy for invasive aspergillosis

7. 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. HANDWASHING and strict aseptic technique
   g. Venous cannula must be inspected daily for signs of phlebitis and changed every 72h or when necessary. Central devices are to be removed if there is clinical deterioration in spite of appropriate antibiotics for 48-72h

References:

1. NCCN Clinical Practice Guidelines in Oncology V.I2006. Fever and Neutropaenia
2. Hughes W T, Armstrong D, Bodey G P 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 D W, Patterson T F et al. Voriconazole versus amphotericin B for primary therapy of invasive aspergillosis. NEJM 2002 ; 347: 408-415
4. WalshTJ, Teppler H, Donowitz G R et al .Caspofungin versus liposomal amphotericin B for empirical antifungal therapy in patients with persistent fever and neutropaenia. NEJM 2004;351(14):1391-1402
5. Dellinger RP, Levy MM, Carlet JM et al. Surviving sepsis campaign : international guidelines for management of severe sepsis and septic shock. Intensive Care Med 2008, 34 : 17-60
6. Bohlius J, Herbst C, Reiser M, Schwarzer G, Engert A. Granulopoiesis-stimulating factors to prevent adverse effects in the treatment of malignant lymphoma. *Cochrane Database of Systematic Reviews* 2008, Issue 4.
7. Alison GF, Eirc JB, Kent A S et al. IDSA guideline : Clinical Practice guideline for the Use of Antimicrobial Agents in Neutropenic Patients with cancer :2010 update by the Infectious Diseases Society of America . CID 2011; 52: 56-93.

8. Mica P, Sara B, Abigail F, Liat v and Leonard L. Empirical antibiotics against Gram-positive infections for febrile neutropenia : Systemic review and meta-analysis of randomized controlled trials. J Antimicrob Chemother 2005; 55: 436-444.
9. Diana A, ChristinaO, Catherine C et al. European guidelines for empirical antibacterial therapy for febrile neutropenic patients in the era of growing resistance: summary of the 2011 4th European conference on the infections in Leukaemia. Haematologica 2013;98(12) :1826-1835
10.Paul M, Yahav D, Fraser A, et al. Empirical antibiotic monotherapy for febrile neutropenia: Systematic review and meta-analysis of randomized controlled trials. J Antimicrob Chemother 2006;57:176-89.
11.Engelhard D. Akova M, Boeckh MJ et al. Bacterial infection prevention after hematopoietic cell transplantation. Bone marrow Transplant 2009; 44:467-470.
12. Cornely OA, Bohme A, Buchheidt D et al. Primary prophylaxis of invasive fungal infections in patients with hematologic malignancies. Recommendations of the Infectious Diseases Working Party of the German Society for Haematology and oncology. Haematologica 2009; 94: 113-22.
13. Zaia J, Baden L, Boeckh MJ et al. viral disease protection after hematopoietic cell transplantation. Bone marrow Transplant 2009; 44:471-482.

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 , HSV
< 250/µl	PCP, esophageal candidiasis, PML, , HIV encephalopathy
< 100/µl	Cerebral toxoplasmosis, , cryptococcosis, miliary tuberculosis
< 50/µl	CMV end organ disease , 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

Reference:

Panel on Opportunistic Infections in HIV-Infected Adults and Adolescents. Guidelines for the prevention and treatment of opportunistic infections in HIV-infected adults and adolescents Rrecommendations from the CDC, NIH and IDSA, 2013

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Pneumocystis pneumonia (PCP)			
Pneumocystic jiroveci (carinii) Interstitial Pneumonia	Trimethoprim /Sulfamethoxazole 15-20mg/kg / 75-100mg/kg/24h IV/PO (excellent bioavailability) q6h-q8h for 21 days	**For severe cases: (PO2 < 70mmHg)** Pentamidine 4mg/kg/24h IV (in 1 pint D5% or N/S run over 1-2 hours) for 21 days **OR** Primaquine 30 mg (base) PO q24h **PLUS** Clindamycin 600 mg q6h IV/ 900 mg IV q8h **For mild to moderate cases: (PO2 70-80mmHg)** Clindamycin 600mg IV q8h/ 300-450mg PO q6h-q8h **PLUS** Primaquine 30mg base PO q24h for 21 days **OR** Dapsone 100mg PO q24h **PLUS** Trimethoprim 15mg/kg/24h PO q8h	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 Patients given Dapsone or primaquine should be tested for G6PD deficiency.
Prophylaxis (primary and secondary) *Indications:* • CD4 count <200 cells/mm^3 • Oropharyngeal candidiasis • CD4% <14%	Trimethoprim/Sulfamethoxazole 80/400mg-160/800mg PO q24h	Dapsone 100mg PO q24h **OR** Aerosolized Pentamidine 300mg monthly via Respiguard II nebulizer or ultrasonic nebulizer +O2 agonist	Patients receiving pyrimethamine/sulfadiazine for treatment or suppression of toxoplasmosis do not require additional prophylaxis for PCP

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
• Evidence of AIDS-defining illness • CD4 count 250-200 and if CD4 monitoring (e.g., every 3 months**) is not possible**			**Discontinuation:** Consider in patients on HAART with CD4 > 200 for at least 3 months **Restarting prophylaxis:** CD4 count falls to <200 or PCP recurred at a CD4 count >200 cells/mm^3 (lifelong prophylaxis should be considered)
Mucocutaneous Candidiasis			
Oropharyngeal (oral thrush)	Fluconazole 100mg PO q24h for 7-14 days	Nystatin suspension 500,000 units PO q6h **OR** Itraconazole 200mg PO q24h	Chronic suppressive therapy is usually not recommended unless patients have frequent or severe recurrences. If used, it is reasonable to discontinue therapy if CD4 >200 cells/µL
Oesophageal	Fluconazole 200-400mg PO/IV q24h for 14-21 days	Itraconazole 200mg PO q24h **OR** Voriconazole 200mg PO/IV q12h **OR** Amphotericin B 0.6mg/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
Vulvovaginal	Azoles pessary (Clotrimazole) for 3-7 days	Fluconazole 150mg PO stat **OR** Itraconazole 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**	
Cryptococcal meningitis or meningoencephalitis			
Cryptococcus neoformans **Initial Treatment** Induction therapy **(for at least 2 weeks)**	Amphotericin B deoxycholate[i] 0.7-1mg/kg IV q24h **PLUS** Flucytosine 25mg/kg PO q6h	Amphotericin B deoxycholate[i] 0.7-1mg/kg IV q24h **PLUS** Fluconazole 800mg IV/PO q24h	[i] The lipid formulations (Amphotericin B lipid complex 5mg/kg or liposomal 3-4mg/kg IV q24h) may be used instead if available If ICP >250mm or signs & symptoms 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 VP shunt
Consolidation therapy **(for 8 weeks)**	Fluconazole 400mg PO q24h	Itraconazole 200mg PO q12h	
Maintenance Therapy **(continued after consolidation)**	Fluconazole 200mg PO q24h	Itraconazole 200mg PO q24h for patients intolerant or failed Fluconazole	**Discontinuation:** • Completed initial (induction, consolidation) therapy, and at least 1 year on maintenance therapy, and • Remains asymptomatic from cryptococcal infection, and • CD4 count ≥100 cells/μL for ≥3 months and suppressed HIV RNA in response to effective ART **(http://aidsinfo.nih.gov/ contentfiles/ lvguidelines/ adult_oi.pdf.)**
Secondary prophylaxis	Fluconazole 200mg PO q24h		Secondary prophylaxis: CD4 count decreases again to <100 cells/mm3
Toxoplasma Gondii Encephalitis			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Acute Infection (up to 97% patients are Toxo IgG +ve)	Pyrimethamine* 200mg PO loading dose followed by Pyrimethamine 50mg (if BW≤60kg), 75mg (if BW>60kg) PO q24h **PLUS** Folinic acid 10-25mg PO q24h **PLUS** Clindamycin 600mg IV/PO q6h for at least 6 weeks **OR** Sulfadoxine/Pyrimethamine 500/25mg (Fansidar®) PO 1 tab q12h **PLUS** Folinic acid 10-25mg PO q24h **PLUS** Clindamycin 600mg IV/PO q6h for at least 6 weeks	Pyrimethamine* (dosing as per preferred regime) **PLUS** Folinic acid 10-25mg PO q24h **PLUS** Sulfadiazine* 1-1.5gm PO q6h for at least 6 weeks **OR** Trimethoprim/Sulfamethoxazole (5mg/kg TMP/ 25mg/kg SMX) IV/PO q12h for at least 6 weeks	**Adjunctive corticosteroids** (e.g. dexamethasone) should be administered when clinically indicated to treat 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 *Requires DG approval
Suppressive/ Maintenance Therapy	Pyrimethamine* 25-50mg PO q24h **PLUS** Clindamycin 600mg PO q8h **PLUS** Folinic acid 10-25mg q24h	Pyrimethamine* 25-50mg PO q24h **PLUS** Folinic acid 10-25mg q24h **PLUS** Sulphadiazine* 0.5-1g PO q6h **OR** Trimethoprim/ Sulfamethoxazole 160/800mg PO q12h	**Discontinuation:** Consider when on HAART, CD4 >200 >3 months and viral load well suppressed *Requires DG approval
Primary Prophylaxis	Trimethoprim/ Sulfamethoxazole 160/800mg PO q24h	Dapsone 50mg PO q24h **PLUS** Pyrimethamine* 50mg PO q7d	All the recommended regimens for preventing 1st episode of toxoplasmosis are also effective in preventing PCP

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Indications: ToxoIgG +ve with CD4<100		**PLUS** Folinic acid 25mg PO q7d **OR** Dapsone 200mg PO q7d **PLUS** Pyrimethamine* 75mg P q7d **PLUS** Folinic Acid 25mg PO q7d	*Requires DG approval
***Mycobacterium Avium* Complex (MAC) Disease**			
Treatment	Clarithromycin 500mg PO q12h **PLUS** Ethambutol 15mg/kg PO q24h **PLUS/MINUS[ŧ]** Amikacin[1] 10-15mg/kg IV q24h **OR** Streptomycin 1gm IM q24h **OR** Levofloxacin 500mg PO q24h **OR** Moxifloxacin 400mg PO q24h	Azithromycin 500-1000mg PO q24h **PLUS** Ethambutol 15mg/kg PO q24h	[ŧ]Addition of 3rd/4th drug should be considered for patients with CD4 count <50, high mycobacterial loads (>2 log CFU/mL of blood), or in the absence of effective HAART **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 therapy
Mainternance/ Secondary Prophylaxis	Same as the treatment regimen		Secondary prophylaxis restarted when CD4<100
Primary Prophylaxis Indications: CD4 < 50 cells Ruled out active MAC and TB	Azithromycin 1250mg PO once weekly	Clarithromycin 500mg PO q12h	**Discontinuation:** Consider if patient is on HAART and viral load well suppressed, CD4 > 100 ≥3 months

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Cytomegalovirus (CMV) Disease			
CMV Retinitis Initial Therapy Immediate Sight-Threatening Lesions (Adjacent to the Optic Nerve or Fovea) For Small Peripheral Lesions	 Intravitreal injections of Ganciclovir (2mg/injection) 1-4 doses over 7-10 days **PLUS** Ganciclovir 5mg/kg IV q12h for 14-21 days, then 5mg/kg IV q24h 5–7 times weekly Gancyclovir 5mg/kg IV q12h for 14 days	 Foscarnet* (2.4mg/injection) for 1-4 doses over a period of 7-10 days **PLUS** Ganciclovir 5mg/kg IV q12h for 14-21 days, then Valganciclovir* 900mg PO q24h	 Immune recovery is essential for successful treatment. Start HAART within 2 weeks if possible **Discontinuation:** Consider if patient is on HAART and viral load well suppressed, CD4 > 100 ≥3 months and after 3-6 months of CMV treatment. *Requires DG approval
Extraocular CMV diseases (Oesephagitis, colitis, interstitial pneumonitis, neurological) Secondary prophylaxis (CD4 + count <100 cells/mm3)	Ganciclovir 5mg/kg IV q12h for 21-42 days or until signs and symptoms have been resolved Ganciclovir 5mg/kg IV q24h 5–7 times weekly	May consider switch to Valganciclovir 900mg PO q12h once patient can absorb and tolerate orally (in CMV oesophagitis and colitis only) Valganciclovir* 900mg PO q24h	Maintenance therapy is generally not necessary; HAART offers best hope for prevention of relapses *Requires DG approval
Bacterial Enteric Infections			
Salmonellosis *Salmonella* non-typhi	Ciprofloxacin 500-750mg PO q12h OR 400mg IV q12h	Trimethoprim/Sulfamethoxazole 160/800mg IV/PO q12h **OR** Ceftriaxone 1gm IV q24h	**Duration:** CD4≥200: 7-14 days. If CD4 <200 and with bacteremia: 6 weeks. Longer course with debridement and drainage needed for presistent bacteremia or metastaic disease
Shigellosis	Same regime as salmonellosis		**Duration:**

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Shigella sp.			Gastroenteritis: 7-10 days Bacteraemia: ≥14 days Recurrent: 2-6 weeks
Campylobacteriosis *Campylobacter* sp.	**Mild to Moderate Disease** Same regime as salmonellosis **Bacteraemia** Ciprofloxacin 500-750mg PO q12h OR 400mg IV q12h **PLUS** Aminoglycoside IV		**Duration:** Refer to shigellosis
Herpes Simplex Virus (HSV) Infections			
Genital or orolabial Moderate-to-severe mucocutaneous infections Suppressive therapy	Acyclovir 400mg PO q8h Acyclovir 5mg/kg IV q8h After lesion begins to regress, change to oral regime as above and continue until lesions have completely healed Acyclovir 400mg PO q12h		**Duration:** Genital : 5-14 days Orolabial: 5-10 days Suppressive therapy indicated if severe/frequent recurrences Duration: Continue indefinitely
Varicella-Zoster Virus Diseases			
Herpes Zoster (Shingles) Primary Varicella Infection (Chickenpox) including progressive outer retinal necrosis (PORN) and acute retinal necrosis (ARN)	**Uncompliclated/Acute Localized Dermatomal** Acyclovir 800mg PO 5x/day for 7-10 days (shingles), 5-7 days (chicnkenpox). Longer duration maybe needed for slow to resolve lesions **Severe infection (CNS, ocular, disseminated)**		Consider treatment for severe infection whenever clinical diagnosis of zoster likely with altered mental status or visual symptoms while definitive diagnosis pursued

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Acyclovir 10-15mg/kg IV q8h, then switch to oral regime as above when improved for 10-14 days(shingles), 7-10 days(chickenpox)		
Histoplasmosis			
Histoplasma capsulatum Moderate- to-severe disseminated disease	**Induction therapy** Amphotericin B[‡] 0.6-0.7mg/kg IV q24h for at least 2 weeks or clinical improvement **Maintenance therapy** Itraconazole 200mg PO q8h for 3 days, then q12h for at least 12 months		All the triazole antifungals have the potential to interact with certain ARV agents and other anti-infective agents. [‡]The lipid formulations of amphotericin B may be used instead if available
Less severe disseminated disease	Itraconazole 200mg PO q8h for 3 days, then 200mg PO q12h for at least 12 weeks	Fluconazole 800 mg PO q24h **OR** Voriconazole 400mg PO q12h on day 1, then 200mg PO q12h	Itraconazole oral solution is preferred over capsule because of improved absorption, but is less well tolerated. However, this formulation may not be necessary if itraconazole concentration is increased by concomitant use of a CYP3A4 inhibitor such as ritonavir-boosted PIs
Chronic Suppresive therapy (Secondary prophylaxis) Indication: • severe disseminated or CNS infection after	Itraconazole 200mg PO q24h	Fluconazole 400mg PO q24h	**Discontinuation:** • Received azole for >1 year, and • Negative fungal blood cultures, and • Serum Histoplasma antigen <2 ng/mL, and • CD4 count >150 for ≥6 months

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
completion of at least 12 months of treatment • relapsed despite appropriate initial therapy • CD4<150			
***Isospora Belli* Infection**			
Initial Therapy	Trimethoprim/Sulfamethoxazole 160/800mg PO/IV q6h for 10 days	Pyrimethamine 50-75mg PO q24h **PLUS** Folinic acid 5-10mg PO q24h **OR** Ciprofloxacin 500mg PO q12h	
***Nocardia* infection**			
Initial Therapy	Trimethoprim/ Sulfamethoxazole (TMP 15mg/kg /SMX 75mg/kg/24h) IV/PO q6h May consider decreasing to SMX/TMP (TMP 10mg/kg/24h) after clinical improvement	Imipenem/Cilastatin 500mg IV q6h **PLUS** Amikacin 7.5mg/kg IV q12h for 2-4 weeks or clinical improvement followed by oral regimen **OR** *3rd gen. Cephalosporins, e.g.* Ceftriaxone 2gm IV q12-24h **PLUS** Amikacin 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 160/800mg q12h
Penicilliosis			
Penicillium marneffei Acute infection	**Severely-ill patients** Amphotericin B[‡] 0.6-0.7mg/kg IV	Voriconazole 6 mg/kg IV q12h on day 1, then 4 mg/kg IV q12h for at	[‡] The lipid formulations of amphotericin B may be used instead if available.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	for 2 weeks, followed by Itraconazole 200mg PO q12h for 10 weeks **Mild disease** Itraconazole 200mg PO q12h for 8 weeks	least 3 days, followed by voriconazole 200 mg PO q12h for a maximum of 12 weeks Voriconazole 400mg PO q12h on day 1, then 200mg PO q12h for a maximum of 12 weeks	Have to be followed by chronic maintenance therapy.
Maintenance therapy/ Secondary prophylaxis	Itraconazole 200mg PO q24h		**Discontinuation:** CD4 count >100 for ≥6 months
Progressive Multifocal Leukoencephalopathy (PML)			
Polyoma virus JC virus (JCV)	No effective therapy exists		With HAART, some patients improve and others stabilise. Few may deteriorate due to immune reconstitution
Cryptosporidiosis			
***Cryptosporidium* sp.**	Symptomatic treatment of diarrhoea		Effective HAART (to increase CD4+ >100) can result in complete, sustained clinical, microbiological and histologic resolution.

C. SOLID TRANSPLANT

For infections related to renal transplant – please refer to the MOH Renal Replacement Therapy Guidelines

OCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Blepharitis *Staph. aureus* *Staph. epidermidis*	Eyelid hygiene/scrubs is the mainstay of therapy Topical antibiotics are not indicated as an initial therapy	Oxytetracycline with Polymyxin B eye ointment applied q12h to the lid margin **OR** Fusidic Acid 1% eye ointment applied q12h to the lid margin	In resistant cases, Doxycycline 100mg PO q24h or Tetracycline 250mg PO q6h for 2-6 weeks or as necessary. Tetracyclines are contraindicated in children <8 years. The option would be Erythromycin Ethylsuccinate 30-50mg/kg/day PO q6h
Internal Hordeolum with Secondary Infection *Staph. aureus* In the presence of superficial cellulitis or abscess	Warm compresses Cloxacillin 500mg PO q6h for 5 days	 Amoxycillin 500mg PO q8h for 5 days	Systemic antibiotics are indicated in the presence of superficial cellulitis or abscess No topical antibiotics are indicated
External Hordeolum (Stye) *Staph. aureus* In the presence of superficial cellulitis or abscess	Epilation of affected eye lash and warm compresses No antibiotic recommended as condition is self limiting Cloxacillin 500mg PO q6h for 5 days **OR** Amoxycillin 500mg PO q8h for 5 days		Systemic antibiotics are indicated in the presence of superficial cellulitis or abscess
Bacterial Conjunctivitis *Staph aureus, Strep pneumonia, H. influenzae*			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Non severe conjunctivitis Severe conjunctivitis	Chloramphenicol 0.5% eye drop q2-4h for 1 week Gentamicin 0.3% eye drop q2-4h for 1 week **OR** Moxifloxacin 0.5% eye drop q2-4h for 1 week **OR** Ciprofloxacin 0.3% eye drop q2-4h for 1 week		
Gonococcal Conjunctivitis (including neonates) *Neisseria Gonorrhoea*	Requires systemic therapy. Refer to Sexually Transmitted Infections & Neonatal Infection Sections		Copious irrigation with topical saline drops or artificial tears every 30-60 minutes Ciprofloxacin 0.3% eye drop q2h may supplement but cannot replace systemic therapy
Chlamydial Conjunctivitis (including neonates) *Chlamydial Trachomatis*	Requires systemic therapy. Refer to Sexually Transmitted Infections & Neonatal Infection Sections		Topical antibiotics are not indicated
Bacterial Keratitis No Growth/ Mixed Growth Non severe keratitis (small peripheral keratitis) may consider monotherapy	Ciprofloxacin 0.3% eye drop q1-2h **OR**		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

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Severe bacterial keratitis dual therapy is advocated	Moxifloxacin 0 .5% eye drop q1-2h *Cefuroxime 5% eye drop q1-2h **PLUS** *Gentamicin 0.9% or 1.4% eye drop q1-2h		*Prepared ready to use extemporaneous by using injectable forms
Contact Lens Related Bacterial Keratitis *No Growth* Non severe keratitis (small peripheral keratitis) may consider monotherapy Severe bacterial keratitis dual therapy is advocated	Ciprofloxacin 0.3% eye drop q1-2h *Gentamicin 0.9% or 1.4% eye drop q1-2h **PLUS** *Ceftazidime 5% eye drop q1-2h		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 *Prepared ready to use extemporaneous by using injectable forms
Bacterial Keratitis Gram-Positive Cocci Gram-Negative Rods Gram-Negative Cocci	*Cefuroxime 5% eye drop q1-2h *Gentamicin 0.9% or 1.4% eye drop q1-2h *Gentamicin 0.9% or 1.4% eye drop q1-2h	Moxifloxacin 0 .5% eye drop q1-2h *Ceftazidime 5% eye drop q1-2h **OR** Ciprofloxacin 0.3% eye drop q1-2h *Ceftazidime 5% eye drop q1-2h **OR** Ciprofloxacin 0.3% eye drop q1-	Commence a loading dose of one drop every 15minutes for 3 hours followed by hourly drops around the clock. Taper based on clinical response Vancomycin 5% eye drop may be indicated for MRSA *Prepared ready to use extemporaneous by using injectable forms

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		2h **OR** Moxifloxacin 0 .5% eye drop q1-2h	
Acanthamoeba Keratitis *Acanthamoeba* sp.	*Chlorhexidine 0.02% eye drop q1-2h **PLUS** **Propamidine isethionate 0.1% q1-2h		Topical therapy tapered with response over a duration of 6-12 month *Prepared ready to use extemporaneous by using injectable forms **Requires DG approval
Gonococcal Kerato conjunctivitis *Neisseria Gonorrhoea*	Requires systemic therapy. Refer to Sexually Transmitted Infections & Neonatal Infection Sections **PLUS** Ciprofloxacin 0.3% eye drop q1-2h	*Ceftazidime 5% eyedrop q1-2h **OR** *Gentamicin 0.9% or 1.4% eye drop q1-2h **OR** Moxifloxacin 0.5% eye drop q1-2h	Commence a loading dose of one drop every 15minutes for 3 hours followed by hourly drops around the clock. Taper based on clinical response *Prepared ready to use extemporaneous by using injectable forms
Fungal Keratitis Filamentous Fungi/Yeast	*Amphotericin B 0.15%-0.2% eye drop q1-2h **PLUS** *Fluconozole 0.2% eye dropq 1-2h **PLUS** Fluconozole 200mg PO q24h	**Natamycin 5% eye drop q1-2h **OR** **Voriconazole 1% eye drop q1-2h **PLUS** Ketoconazole 200mg PO q24h	Topical therapy tapered with response *Prepare ready to use extemporaneous **Requires DG approval References: Sun CQ, Lalitha P, Prajna NV, Karpagam R, Geetha M, O'Brien KS, Oldenburg CE, Ray KJ, McLeod SD, Acharya NR, Lietman TM; Mycotic Ulcer Treatment Trial Group Association between In Vitro Susceptibility to

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
			Natamycin and Voriconazole and Clinical Outcomes in Fungal Keratitis. Ophthalmology 2014 Apr 15. pii:S0161-6420(14)00202-4. doi: 0.1016/j. ophtha. 2014.03. 004. LohAR, Hong K, Lee S, Mannis M, Acharya NR. Practice patterns in the management offungalcorneal ul cers. Cornea. 2009;28(8) :856-859.
Herpes Simplex Keratitis Herpes Simplex Type 1 & 2 Epithelial Keratitis Non-necrotizing Stromal Keratitis Necrotizing Stromal Keratitis Recurrent Herpes Simplex Stromal Keratitis	 Acyclovir 3% eye ointment 5 times/day In addition to topical corticosteroids Acyclovir 3% eye ointment 5 times/day Superadded bacterial or fungal infection must be excluded **PLUS** Acyclovir 400mg PO 5 times/day Prophylaxis: Acyclovir 400mg PO q12h for 12 months		 Acyclovir 3% eye ointment 5 times/day is used as a prophylactic against epithelial keratitis
Herpes Zoster Ophthalmicus *Herpes Zoster Virus*	Needs systemic therapy Refer to Skin & Soft Tissue Infections Section		
Ocular Toxoplasmosis *Toxoplasma gondii*	TMP /SMX 960mg PO q12h	Pyrimethamine 25-50mg PO q24H	Pregnancy : May consider Intravitreal Clindamycin 1.0mg /0.1mls

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		PLUS Folinic acid 10-25mg PO q24H **PLUS** Sulfadiazine 1gm PO q6H **OR** Azitromycin 500mg PO q24h **OR** Clindamycin 300mg PO q6H x 3-4 weeks, then 150mg q6H PO x 3-4 weeks	Systemic steroids are usually indicated in immunocompetent patients *Prophylaxis for recurrent lesions: T. Bactrim 480mg q12H PO three times a week Reference: Sobrin L, Kump L, Foster CS. Intravitreal clindamycin for toxoplasmic retinochoroiditis Retina 2007. Sep;27(7): 952-7.
Acute Retinal Necrosis *Herpes Simplex*	Acyclovir 10mg/kg/dose IV q8h for 12 weeks (not more than 800mg) **FOLLOWED BY** Acyclovir 800mg PO 5 times/day for 6 weeks	* Valacyclovir 1gm PO q8H	* Requires DG approval Systemic steroid is indicated depending on location or severity of the infection References: Patrick MKT, Claire Y H, Susan L. Antiviral selection in the management of acute retinal necrosis. Clinical Ophthalmology 2010:4 11–20 Peter R, Jost H, Livia G, et al. Virus Diagnostics and Antiviral Therapy in Acute Retinal Necrosis (ARN). Antiviral Drugs – Aspects of Clinical Use and Recent Advances. Intechopen. MN Muthiah, M Michaelides, CS Child, et al. Acute retinal necrosis: a national population-based study to assess the incidence, methods of diagnosis, treatment strategies and outcomes in the UK. Br J Ophthalmol 2007;91:1452–1455 Simon RJT, Robin H, Claire YH, Sue Lightman. Valacyclovir in the treatment of acute retinal

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
			necrosis. BMC Ophthalmology 2012, 12:48. Robert WW, Emmett TC et al. Diagnosing and Managing Acute Retinal Necrosis. Retinal Physician.
CMV Retinitis *Cytomegalovirus*	Ganciclovir 5mg/kg IV q12h for 2-3 weeks Intravitreal Ganciclovir 2mg/0.1ml biweekly	* Valganciclovir: 900mg PO q12h for 3 weeks (induction) followed by 900mg PO q24h for 1 week Intravitreal *Foscarnet 2.4mg/0.1ml (1-2weekly)	Systemic therapy is indicated in all cases. Intravitreal therapy is indicated in zone 1 and 2 lesions. Intravitreal to be tapered according • Toclinicalresponse • May need to continue until CD4 count is >150cell/mm3 Ganciclovir implant: 4.5gm an option to intravitreal Ganciclovir *Requires DG approval
Ocular Syphilis *Treponemap Pallidum*	Ocular Syphilis (syphilitic uveitis) should be treated as Neurosyphilis Refer to Sexually Transmitted Infections Section		Referral to Physician/ID Physician
Ocular Tuberculosis *Mycobacterium Tuberculosis*	Needs systemic therapy Refer to Tuberculosis Infections Section Ethambutol may cause optic neuropathy and should avoided depending on the case		**Ocular TB***:* presents as a unilateral/ bilateral infective uveitis characterized by multifocal choroiditis/ granuloma and there may be supportive FFA findings of occlusive vasculitis. The diagnosis maybe clinical as vitreous sampling for AFB or TB PCR may not be very sensitive due to small sample size and sensitivity of the tests. Clinical response to anti-TB is often diagnostic.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
			Uveitis secondary to TB **Hypersensitivity** is an immune response to acid fast bacilli in the eye and manifests predominantly as an inflammatory uveitis. Treatment includes anti-TB in combination with an immunosuppressive dose of systemic steroids for at least 6-9 months. Systemic steroid maybe indicated but is only for -non-activesystemicTB -severe ocular inflammation and vision threatening condition References Helm CJ, Holland GN. Ocular tuberculosis.Surv Ophthalmol. 1993 Nov-Dec;38(3):229-56 Bodaghi B[1], LeHoang P. Ocular tuberculosis. Curr Opin Ophthalmol. 2000 Dec;11(6):443-8
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 **PLUS** Ceftazidime 2mg in 0.1ml If suspicious of fungal endophthalmitis: **ADD** Intravitreal Amphotericin B 0.005mg in 0.1ml	**Intravitreal antibiotic injections:** Vancomycin 1-2mg in 0.1ml **PLUS** Amikacin 0.4mg in 0.1ml	Systemic antibiotics are indicated in severe, virulent endophthalmitis Repeat intravitreal antibiotics after 48 to 72 hours if indicated **Endogenous Endophthalmitis:** Treatment is based on primary infection (bacterial/fungal etc) and culture and sensitivity results. All cases require systemic therapy. Intravitreal injection is indicated in

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Topical treatment-options Systemic treatment	Ceftazidime 5% eye drop, Vancomycin 5% eye drop, Gentamycin 1.2% eye drop Moxifloxacin 0.5% eye drop(monotherapy or combination) Ciprofloxacin 750mg PO q12h for 10 days For culture negative cases add: Clarithromycin 250-500mg PO q12h for 7-14 days	* Moxifloxacin 400mg PO q24h for 10 days (caution in children) **OR** Vancomycin and Ceftazidime IV	cases with vitreous involvement and sight threatening lesions. Do not use systemic steroids
Post Operative Fungal Endophthalmitis	Intravitreal Amphotericin B 0.005mg in 0.1ml Fluconazole 200mg PO q24h for 6 weeks (minimum)	*Intravitreal Miconazole (0.01mg in 0.1ml) **OR** *Intravitreal Voriconazole 50ug-100ug/0.1mls * Voriconazole 200mg PO q12h	Intravitreal and Systemic therapy are indicated in all cases *Requires DG approval CPG for Management of Post- Operative Endophthalmitis, Ministry of Health Malaysia, August 2006
Endogenous Endophthalmitis **Systemic treatment** **Topical treatment-options:**	Ciprofloxacin 750mg PO q12h for 10days For culture negative cases add: Clarithromycin 250-500mg PO q12h for 7-14 days Ceftazidime 5% eye drop, Vancomycin 5% eye drop, Gentamycin 1.2% eye drop	*Moxifloxacin 400mg PO q24h for 10 days (caution in children) **OR** Vancomycin and Ceftazidime IV	Treatment is based on primary infection (bacterial/fungal etc) and culture and sensitivity results. All cases require systemic therapy. Intravitreal injection is indicated in cases with vitreous involvement and sight threatening chroidal lesions.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Intravitreal antibiotic injections:	Moxifloxacin 0.5% eye drop(monotherapy or combination) Vancomycin 1-2mg in 0.1ml **PLUS** Ceftazidime 2mg in 0.1ml If suspicious of fungal endophthalmitis, **ADD** Intravitreal Amphotericin B 0.005mg in 0.1ml	Vancomycin 1-2mg in 0.1ml **PLUS** Amikacin 0.4mg in 0.1ml	Topical therapy may supplement therapy. Not to use systemic steroids in these cases Review antibiotic regimen after microbiology results.Repeat intravitreal antibiotics after 48 to 72 hours if indicated
Dacryocystitis *Strep pneumonia, Staph aureus,* Gram-ve Anaerobes	Cefuroxime 250mg PO q12h for 7 days	Amoxycillin/ Clavulanate 625mg PO q8h for 7 days	Consider intravenous antibiotics in severe infections
Preseptal Cellulitis *Strep pneumoniae,Staph aureus, Strepcoccus* sp.	Cloxacillin 500mg -1gm PO q6h for 5 days	Amoxycillin/Clavulanate 625mg PO q8h for 7 days **OR** Ceftriaxone 1-2gm IV q24h	Consider intravenous antibiotics in severe infections
Orbital Cellulitis/abcess *Strep pneumoniae, Staph aureus, Strepcoccus* sp. Gram-ve Anaerobes	Amoxycillin/ Clavulanate 1.2gm q8h IV for 7-10 days **If Anaerobes suspected:** **ADD** Metronidazole 500mg IV q8h for 7-10 days	Ceftriaxone 1-2gm q24h IV for 7-10 days	Periorbital and orbital cellulitis : A 10 year review of Hospitalized children. *Eur J Ophthalmol 2010;20(6): 1066-1072* Microbiology and Antibiotic Management of Orbital Cellulitis *Pediatrics 2011;127;e566*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	

General Sore Throat

The modified Centor score can be used to help physicians decide which patients need no testing, throat culture/rapid antigen detection testing, or empiric antibiotic therapy.

The cumulative score determines the likelihood of streptococcal pharyngitis and the need for antibiotics

Criteria	Score	Age	Score
Absence of cough	1	3 to 14 years	1
Swollen and tender anterior cervical lymph nodes	1	15 to 44 years	0
Temperature > 100.4° F (38° C)	1	45 years and older	-1
Tonsillar exudates or swelling	1		

Cumulative score

Total score	Risk	Comment
0 or 1	Low risk	Do not require testing or antibiotic therapy
2 or 3		Testing recommended. Positive results warrants antibiotics. If test not available, antibiotics may be considered
4 or more	High risk	Empiric therapy may be considered

References :

A clinical score to reduce unnecessary antibiotic use in patients with sore throat. CAN MED ASSOC J • JAN. 13, 1998

1. Throat And Upper Respiratory

Tonsillitis / Pharyngitis Group A *Streptococcus*	Phenoxymethylpenicillin 500mg PO q12h for 10 days **OR**	Amoxicillin 500mg PO q8-12h for 10 days **Penicillin Allergy:**	Antibiotics should be prescribed in suspected/proven bacterial infections, only as sore throats are common viral in origin.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Benzathine Penicillin 1. 2MU IM, 1 single dose	Azithromycin 500mg PO q24h for 5 days **OR** Clindamycin 300-450mg PO q8h for 10 days	
Acute Peritonsillar Abscess Group A *Streptococcus* *Staphylococcus aureus* *Haemophilus influenza* *Fusobacterium* necrophorum	Ampicillin/Sulbactam 3 g IV q6h **OR** Amoxycillin/Clavulanate 1.2gm IV q8h **OR** Benzylpenicillin (Penicillin G) 2 MU IV q6h **PLUS** Metronidazole 500mg IV q6-8h for 10-14 days	Amoxicillin/Clavulanate 625 mg PO q8h **OR** Phenoxymethylpenicillin 500mg PO q6h **PLUS** Metronidazole 500mg PO q6h **OR** Clindamycin 300-450mg PO q6h **Penicillin Allergy:** Clindamycin 600mg IV q8h	Abscess to be drained
Diphteria *Corynebacterium diphtheriae*	Antitoxin **PLUS** Erythromycin Lactobionate 500mg IV q6h followed by Erythromycin Ethylsuccinate 800mg PO q12h for total of 14 days **OR** Benzylpenicillin 50,000 units/kg to a maximum of 1.2 MU IV q12h followed by Phenoxymethylpenicillin 250mg		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	PO q6h total of 14 days		
Acute Epiglottitis *Haemophilus influenzae* Type b, *Streptococcus pneumoniae*	Ceftriaxone 2gm IV q24h **OR** Ampicillin/Sulbactam 3gm IV q6h <u>Oral step down</u> Amoxicillin/Clavulanate 625mg PO q8h for 7 – 14 days	**Penicillin Allergy:** Clindamycin 600-900mg IV q8h **PLUS** Ciprofloxacin 400mg IV q12h	Urgent hospitalisation. May present with life threatening upper airway obstruction, especially in paediatrics
Deep Neck Space Abscess *Streptococcus pyogenes* *Staphylococcus aureus* *Fusobacterium necrophorum*	Ampicillin/sulbactam 3gm IV q6h 10-14 days **OR** Ceftriaxone 2gm IV q24h **PLUS** Metronidazole 500mg IV q6h		
2. Rhinology			
Acute Bacterial Rhinosinusitis (ABRS) *Streptococcus pneumoniae,* *Haemophilus influenzae,* *Moraxella catarrhalis* Severe infection requiring hospitalization:	Amoxicillin 500mg PO q8h **OR** Amoxicillin/Clavulanate 625mg PO q8h for 5-7 days Ampicillin/Sulbactam 1.5–3gm IV q6h **OR** Amoxicillin/Clavulanate 1.2gm IV q8h **OR** Ceftriaxone 1–2gm IV q12–24h	**B-lactam allergy:** Doxycycline 100mg PO q12h	Pregnant patients with Penicillin Allergy would need to be treated with Azithromycin 500mg PO q24hr

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
3. Otology			
Acute otitis media *Streptococcus pneumoniae,* *Haemophilus influenzae* *M.catarrhalis*	**For severe disease or when risk of complications:** Amoxicillin 500mg PO q8h If not responding 48-72hrs; Amoxicillin/Clavulanate 625mg PO q8h for 5 days **OR** Cefuroxime 500mg PO q12h	**Penicillin Allergy:** Clarithromycin 500mg PO q12h **OR** Azithromycin 500mg PO on day 1, followed by 250mg PO OD on day 2 through day 5	Antibiotics should *not* be routinely prescribed for uncomplicated AOM.
Malignant Otitis Externa/ Necrotizing Otitis Externa *Pseudomonas aeruginosa*	Ciprofloxacin 400mg IV q8h **OR** Ceftazidime 2gm IV q8h followed by Ciprofloxacin 750mg PO q12h for 6 weeks		
Acute Diffuse Otitis Externa *P. aeruginosa* *Staph aureus*	Ofloxacin 0.3% otic solution Instill 10 drops into affected ear(s) once daily for 7 days		Aural toileting required in discharging ears
Chronic Suppurative Otitis Media *P. aeruginosa* *Staph aureus*	Ofloxacin 0.3% otic solution Instill 10 drops into affected ear(s) twice daily for 10-14 days		Aural toileting required in discharging ears
Otomycosis *Aspergillus* sp.	Clotrimazole 1% ear solution, applied twice daily for 10 to 14 days		Aural toileting required.

RESPIRATORY INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
LOWER RESPIRATORY TRACT INFECTIONS			
1. Community Acquired Pneumonia (CAP)			
i. Mild CAP (out-patient) **a. No comorbidity** *Streptococcus pneumonia* *Mycoplasma pneumoniae* *Haemophilus influenza* *Chlamydophila pneumonia* *Klebsiella pneumonia*	**No recent antibiotic therapy** Amoxycillin/Clavulanate 625mg PO q8h for 5-7 days	Ampicillin/Sulbactam 375mg PO q12h for 1 week **OR** Doxycycline 100mg PO q24h for 1 week	Reference : British Throracic Society Guidelines, CAP in Adults
b. Comorbidity or History of recent antibiotic therapy (3 months) *Streptococcus pneumoniae* *Mycoplasma pneumonia* *Haemophilus influenzae*	***Oral Microlides** **PLUS** Amoxycillin/Clavulanate 625mg PO q8h for 1 week	**Penicillin Allergy:** Moxifloxacin 400mg PO q24hr for 7-10 days **OR** Levofloxacin 500mg PO q24hr for 1 week	*Oral microlides (azithromycin/ clarithromycin/ erythromycin) Conservative use of quinolone is recommended to minimise resistant pathogen. Use when patients failed first line regimens or allergic to alternative
ii. Moderate& Severe CAP (not requiring mechanical ventilation) *Streptococcus pneumoniae* *Mycoplasma pneumonia* *Haemophilus influenzae* *Klebsiella pneumoniae Legionella pneumophila* *Chlamydia pneumophila* *Staphylococcus aureus* Other Gram Negative Bacilli *- Enterobacter*	Amoxycillin/Clavulanate 1.2gm IV q8h **OR** Ampicillin/Sulbactam 1.5gm IV q8h **PLUS** Azithromycin 500mg IV/PO q24h	Moxifloxacin 400mg IV q24h **OR** Levofloxacin 500mg IV/PO q24h for 1 week **OR** Ceftriaxone 1-2gm IV q24h for 1 week **PLUS** Azithromycin 500mg IV/PO q24h	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

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
- *Escherichia coli* **Pseudomonas infection** should be suspected in individuals in patient with structural lung disease such as (COPD and CF) known to be colonized with pseudomonas	Piperacillin/Tazobactam 4.5gm IV q6h for 10-14 days **OR** Cefepime 2gm IV q8h for 10-14 days week **PLUS** Azithromycin 500mg IV q24h for 1 week	Cefepime 2gm IV q8h **PLUS** Ciprofloxacin 400mg IV q8h or 750mg PO q12h for 10-14 days	Watch out prolonged QTc with microlides Consider adding aminoglycoside
iii.Severe CAP (requiring mechanical ventilation) *Streptococcus pneumoniae* *Haemophilus influenzae* *Staphylococcus aureus* *Klebsiella pneumoniae* *Mycoplasma pneumoniae* *Legionella pneumophilia* *Chlamydophila pneumoniae* *Burkholderia pseudomallei* ***Pseudomonas aeruginosa***	Amoxycillin/Clavulanate 1.2gm IV q8h **OR** Ceftriaxone 2gm IV q24h **PLUS** Erythromycin Lactobionate 500mg IV q6-8h **OR** Azithromycin 500mg IV q24h If the patient is at risk of melioidosis such as DM area with hugh prevalence of melioidosis consider Ceftazidime as first line. Piperacillin/Tazobactam 4.5gm IV q6h for 2 weeks	Ceftriaxone 2g IV q24h **PLUS** Moxifloxacin 400mg IV q24h **OR** Levofloxacin 500mg IV/PO q24h for 1 week **OR** *Ertapenem 1gm q24h (in patients with risk factors for ESBL-see chapter on ESBL) **PLUS** Azithromycin 500mg IV q24h	*Ertapenem only be used Pseudomonas aeruginosa infection should be suspected in individuals

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	OR Cefepime 2gm IV q8h or 2 weeks		with structural lung disease (bronchiectasis), COAD
***Staphylococcus aureus* (MSSA)**	Cloxacillin 2gm IV q4h		Risk factors (MSSA): 1. ESRF 2. IVDUs 3. Prior antibiotics use especially quinolones 4. Prior influenza. Suspect MSSA pneumonia in the presence of cavitary infiltrates without risk factors for anaerobic aspiration.
2. Lung Abscess			
Anaerobes , *Klebsiella pneumoniae* *Streptococcus intermedius ,* *Streptococcus constellatus,* *Streptococcus anginosus* *Streptococcus viridans* *Norcardia*	Amoxycillin/Clavulanate 1.2gm IV q8h followed by 625mg PO q8h for 4-6 week **OR** Ceftriaxone 2gm IV q24h **PLUS** Metronidazole 500mg IV q8h followed by 400mg PO q8h for 4-6 week	Piperacillin/Tazobactam 4.5gm IV q8hr for 4-6 weeks	Weight adjusted dose for Ceftazidime is 120mg/kg/day in 3-4 divided doses Weight adjusted dose for Meropenem is 25mg/kg, max 1g IV q8h
If suspect melioidosis	Ceftazidime 2gm q6-8h for 4-6 week (see section on melioidodsis)	Meropenem 1gm IV q8h	
Staphylococcus aureus (e.g. among IVDU/ elderly/ pediatric)	Cloxacillin 2gm IV q4-6hr for 4-6 weeks	Vancomycin 15mg/kg in q8-12h (if MRSA suspected or allergic to penicillin) Vancomycin alternative	
3. Empyema Always investigate as per pleural effusion. Drainage via chest tube required. Tuberculosis must be excluded			
Streptococcus pneumonia	Amoxycillin/Clavulanate 1.2gm IV	Ceftriaxone 2gm IV q24h for 4-6	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Streptococcus pyogenes *Staphylococcus aureus* Anaerobes *Enterobactereriaceae*	q8h for 4-6 weeks **OR** Ampicillin/Sulbactam 1.5gm IV q8h for 4-6 weeks	weeks **OR** Cefotaxime 1gm IV q8h **PLUS** Metronidazole 500mg IV q8h followed by 400mg PO q8h for 4-6 weeks	
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 Bronchitis (usually viral) Other pathogens *Mycoplasma pneumonia* *Chlamydophylia pneumonia* *Bordetella pertussis* *B. parapertussis*	No antibiotic unless symptoms persist > 7 days Erythromycin Ethylsuccinate 800mg PO q12h for 1 week	Azithromycin 500mg PO q24h for 5-7 days	Symptoms & risk factors: Cough & sputum without previous pulmonary disease
Chronic Bronchitis without risk factors (simple) *H. influenza* *Haemophilus* spp *M. catarrhalis* *S. pneumoniae*	Amoxycillin/Clavulanate 625mg PO q8h for 1 week **OR** Ampicillin/Sulbactam 375mg PO q12h for 1 week	Cefuroxime 500mg PO q12h for 1 week **OR** Doxycycline 100mg PO q12h for 1 week	Symptoms & risk factors: Increased cough & sputum, purulent sputum,and increased dyspnoea
Chronic Bronchitis with risk	Amoxycillin/Clavulanate 625mg	Moxifloxacin 400mg IV q24h for	**Symptoms & risk factors:**

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
factors (complicated) *H. influenza* *M. catarrhalis* *S. pneumoniae* *Klebsiella* sp Other gram negatives	PO q8h for 10-14 days **OR** Ampicillin/Sulbactam 375mg PO q12h for 10-14 days	10-14 days **OR** Levofloxacin 500mg PO q24h for 10-14 days	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
Early onset HAP (including VAP) and **Low risk for infection with multi-drug resistant (MDR) organisms - < 5 days** *S. pneumoniae* *H. influenzae* *S. aureus* *E. coli* *K. pneumoniae* *P.aeruginosa*	Amoxycillin/Clavulanate 1.2gm IV q8h **OR** Cefuroxime 1.5gm IV q8h Piperacillin/ Tazobactam 4.5gm IV q6h **OR** Cefepime 2gm IV q8h	Ceftriaxone 2gm IV q24h	S. aureus is more common in diabetes mellitus, head trauma Monotherapy is recommended for early onset HAP/VAP/HCAP *Highly dependent on local antibiogram/ prevalent organisms* Consider in patients with chronic lung disease.
Early onset with **MDR risk factors and Late onset** HAP (based on the predominant causative organism in local setting) *MDR Pseudomonas aeruginosa*	Piperacillin/Tazobactam 4.5gm IV q6h	Imipenem 500mg IV q6h **OR**	Use combination therapy if MDR pathogen is suspected

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	OR Cefepime 2gm IV q12h **PLUS** Amikacin 15mg/kg/24h IV **OR** Ciprofloxacin 400mg IV q8h	Meropenem 1gm IV q8h **PLUS** Amikacin 15mg/kg/24h IV **OR** Ciprofloxacin 400mg IV q8h	Aminoglycoside can be stopped after 3-5 days in patients on combination therapy who are responding to treatment
Multi drug resistant *Acinetobacter baumanii*	Cefoperazone/Sulbactam 4gm IV q6-8h **OR** Ampicillin/Sulbactam 3gm IV q3-4h	Polymyxin E loading 7-9MU stat and then 9MU daily in 2-3 divided doses (renal adjusted dose is required)	
ESBL producing *Klebsiella pneumoniae*	Ertapenem IV 1gm q24h	Imipenem 500mg IV q6h **OR** Meropenem 1gm IV q8h	There is lack of adequate data on the pharmacokinetics of once-daily administration of ertapenem in critically ill patients.
Methicillin-resistant *Staphylococcus aureus*	**PLUS** **(if MRSA is suspected)** Vancomycin 1gm IV q12h	Linezolid 600mg IV q12h	

SEXUALLY TRANSMITTED INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Primary Syphilis *Treponema Pallidum* **Secondary Syphilis** **Early Latent Syphilis**	Procaine Penicillin 600,000 units IM q24h for 10 days **OR** Benzathine Penicillin 2.4MU IM STAT	**Penicillin Allergy** Doxycycline 100mg PO q12h for 14 days **OR** Tetracycline 500mg PO q6h for 14 days	Contact tracing: Examine and investigate sex partner and treat when indicated Reference: Malaysian Guideline in the Management of Sexually Transmitted Infections 2014
Late Latent Syphilis **Gummatous syphilis** **Cardiovascular syphilis**	Procaine Penicillin 600,000 units IM q24h for 14 days **OR** Benzathine Penicillin 2.4MU IM weekly for 3 weeks	**Penicillin Allergy** Doxycycline 100mg PO q12h for 28 days **OR** Tetracycline 500mg PO q6h for 28 days	Contact tracing Reference: Centre of Disease Control, USA 2013.
Neurosyphilis	Aqueous crystalline penicillin G, 18-4MU/day, administered 3 - 4 MU q4h IV for 14 days **OR** Procaine Penicillin 2.4MU IM q24h **PLUS** Probenecid 500mg PO q6h for 14 days	Ceftriaxone 2gm IM (with Lidocaine as diluent) or IV (with water for injection as diluent) for 10-14 days (if no anaphylaxis to penicillin)	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: Centre of Disease Control, USA 2013
Syphilis in HIV Primary, secondary, early and	Treat as for non-HIV patients with neurosyphilis	Treat as for non-HIV patients with neurosyphilis	CSF examination should be done. HIV patients with syphilis should be

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
late latent, and of unknown duration			reevaluated clinically and serologically at 3, 6, 9, 12 and 24 months after therapy to detect any treatment failure.
Syphilis in Pregnancy	Benzathine Penicillin 2.4 MU IM **First and second trimester**: single dose **Third trimester**: 2 doses,1 week apart	**Penicillin Allergy** Erythromycin Ethylsuccinate 800mg PO q12h for 14 days **OR** Erythromycin Stearate 500 mg q6h. PO for 14 days (Erythromycin has a high risk of failure to cure the infection in infants. All infants to be treated at birth)	Pregnant ladies with syphilis and history of penicillin allergy to be desensitized only in tertiary centre Tetracycline and Doxycycline are contraindicated in pregnancy Women who are treated in the second half of pregnancy are at risk of premature labour and/ or fetal distress if their treatment precipitates a Jarisch-Herxheimer reaction References: UK National Guidelines on the Management of Syphilis 2008 Malaysian Guideline in the treatment of STD 2014
Gonorrhoea *Neisseria Gonorrhoeae* **Uncomplicated** (Urogenital, Anorectal, Pharyngeal)	Ceftriaxone 500mg IM as a single dose **PLUS** Azithromycin 1gm PO as a single dose **OR** Ceftriaxone 500mg IM as a single dose **PLUS** Doxycycline 100mg q12h PO for 7 days	Azithromycin 2gm PO stat (for severe cephalosporin allergy) **OR** *Spectinomycin 2gm IM stat (less effective for pharyngeal gonorrhea)	Contact tracing Also treat for non-specific urethritis (NSU) in view of high incidence of coexisting NSU in patients with gonorrhea Patient to come back 1 week later for test of cure if alternative treatment is used. Reference: Centre of Disease Control, USA 2013

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Gonococcal Conjunctivitis	Ceftriaxone 500mg IM q24h for 3 days **OR** Ceftriaxone 1gm IM STAT	Azithromycin 2gm PO STAT **PLUS** Doxycycline 100mg PO q12h for 7 days **PLUS** Ciprofloxacin 250mg PO q24h for 3 days **OR** *Spectinomycin 2gm IM q24h for 3 days	Reference: Centre of Disease Control, USA 2013 *Requires DG approval
Gonococcal Epididymitis/ Epididymo-orchitis	Ceftriaxone 500mg IM/IV q24h for 7 days **OR** Ceftriaxone 250mg IM STAT **PLUS** Doxycycline 100mg PO q12h for 10 days	*Spectinomycin 2gm IM q24h for 5-7 days **PLUS** Doxycycline 100mg PO q12h for 14 days **OR** *Spectinomycin 2gm IM q24h for 5-7 days **PLUS** Erythromycin Ethylsuccinate 800mg PO q12h for 14 days	Contact tracing *Requires DG approval References: British Association of Sexual Health and HIV Clinical Effectiveness Guidelines **2008** Centre of Disease Control, CDC 2010 (updated 2013)
Disseminated Gonorrhoea (Acral pustules, arthralgia, tenosynovitis, septic arthritis)	Ceftriaxone 1gm IM/IV q24h for 7 days	Cefotaxime 1gm IV q8h **OR** *Spectinomycin 2gm IM q12h for 7 days	Admit patient Contact tracing Duration of treatment depends on clinical response Reference: Centre of Disease Control, USA 2013
Gonococcal Meningitis	Ceftriaxone 1-2gm IV q12h for 10 to 14 days		Reference: Centre of Disease Control, USA 2013
Gonococcal Endocarditis	Ceftriaxone 1-2gm IV q12h for at least 4 weeks		Reference: Centre of Disease Control, USA 2013

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Chlamydial/Non-Specific Urethritis (NSU)/Non-Specific Genital Infection in Women (NSGI)	Doxycycline 100mg PO q12h for 7 days	Erythromycin Ethylsuccinate 800mg PO q6h for 7 days **OR** Azithromycin 1gm PO stat	Contact tracing Doxycycline and Ofloxacin are contraindicated in pregnancy Quinolone is contraindicated in pregnancy and children less than 18 years old Reference: Centre of Disease Control, USA 2013
Chlamydial/Non-Specific Urethritis (NSU)/Non-Specific Genital Infection in Pregnancy	Azithromycin 1g PO STAT **OR** Amoxycillin 500mg PO q8h for 7 days	Erythromycin Ethylsuccinate 800mg PO q6h for 7 days **OR** Erythromycin Ethylsuccinate 400mg q6h for 14 days	Reference: Centre of Disease Control, USA 2013
Recurrent and persistent Non-gonococcal urethritis	Metronidazole 2gm PO STAT	Metronidazole 400mg q12h for 5 days **PLUS** Erythromycin Stearate 500mg q6h for 3 weeks **OR** Azithromycin 500mg STAT then 250mg q24h for 4 days **PLUS** Metronidazole 400mg q12h for 5 days	Reference: Centre of Disease Control, USA 2013
Chancroid *Haemophilus ducreyi*	Ceftriaxone 250mg IM stat **OR** Azithromycin 1gm PO stat	Erythromycin Ethylsuccinate 800mg PO q12h for 7 days **OR** Erythromycin Stearate 500mg PO q6h for 7 days	Contact tracing Reference: Centre of Disease Control, USA 2013
Lymphogranuloma	Doxycycline 100mg PO q12h	Minocycline 100mg PO q12h for 21	Contact tracing

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Venereum *Chlamydia trachomatis* *Serovar L1, 2, 3*	for 21 days	days **OR** Erythromycin Stearate 500 mg PO q6h for 21 days **OR** Azithromycin 1g PO weekly for 3 weeks	Final duration depends on clinical response Reference: Centre of Disease Control, USA 2013
Granuloma Inguinale *Klebsiella granulomatis*	Doxycycline 100mg PO q12h for 3 weeks and until all lesions completely heal	Trimethoprim/Sulfamethoxazole 160/800mg PO q12h for 3 weeks and until all lesions completely heal **OR** Erythromycin Stearate 500mg PO q6h for 3 weeks and until all lesions completely heal **OR** Azithromycin 1gm PO weekly for 3 weeks or 500mg PO q24h for 7 days and until all lesions completely heal **OR** Ceftriaxone 1gm IV q24h for 3 weeks and until all lesions completely heal	Contact tracing Add Gentamicin 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 References: Centre of Disease Control, USA 2013 British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2008
Trichomoniasis *Trichomonas vaginalis*	Refer to Obstetrics & Gynaecology Infections Section		
Bacterial vaginosis *Gardnerella vaginalis,* Anaerobes	Refer to Obstetrics & Gynaecology Infections Section		
Herpes Genitalis			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Herpes Simplex Virus 1 and 2 First episodic:	Acyclovir 200mg PO 5 times a day for 5 days (max 10 days)	*Valaciclovir 500mg-1gm PO q12h day for 5 days (max 10 days)	*Requires DG aprroval
Recurrent episodic:	Acyclovir 200 mg 5 times /day PO for 5 days **OR** 400mg q8h PO for 5 days **OR** 800mg q12h PO for 5 days **OR** 800mg q8h PO for 2 days (short course)	*Valaciclovir 500mg PO q12h for 5 days **OR** *Valaciclovir 1gm PO q24h for 5 days **OR** *Valaciclovir 500mg PO q12h for 3 days (short course)	
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	*Valaciclovir 500mg PO q24h **OR** *Valaciclovir 1gm PO q24h	Reference: Centre of Disease Control, USA 2013
Herpes Genitalis in HIV Primary:	Acyclovir 400-800mg PO q8-12h for 10 days	*Valaciclovir 500mg PO q12h for 10 days	*Requires DG aprroval
Severe:	Acyclovir 5 to 10mg/kg IV q8h for 2 to 7 days and then followed by Acyclovir PO (min 10 days)		References: Centre of Disease Control, USA 2013 British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2008
Recurrent:	*Valaciclovir 1 gm IV q12h for 5-10 days	Acyclovir 400-800mg PO q8-12h for 10 days	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Suppressive:	Acyclovir 400mg-800mg PO q8-12h for up to 1 year, then reassess	*Valaciclovir 500mg PO q24h **OR** *Valaciclovir 1gm PO q24h	
Herpes Genitalis in pregnancy	As in non pregnant with Herpes genitalis	As in non pregnant with Herpes genitalis	**First and second trimester acquisition** Acyclovir is not licensed for use in pregnancy; however, there is substantial clinical experience supporting its safety i.e. the benefits of antiviral therapy outweigh the risk of withholding treatment (Pregnancy category B**.** Vaginal delivery should be anticipated (IV, C) **Third trimester acquisition:** If a true first episode is confirmed, CS should be considered for all women, particularly those developing symptoms after 34 weeks of gestation, as the risk of viral shedding is very high. If vaginal delivery is unavoidable, acyclovir treatment of mother and baby may be indicated References*:* Centre of Disease Control, USA 2013 British Association of Sexual Health and HIV Clinical Effectiveness Guidelines 2008

SKIN & SOFT TISSUE INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Impetigo *S. aureus* *S. pyogenes* Generalised: Localised:	Cloxacillin 500mg PO q6h for 5-7 days **Penicillin Allergy** Erythromycin Ethylsuccinate 800mg PO q12h for 5-7 days Topical 2% fusidic acid q8-12h for 7 days (Outpatient use only)	Cephalexin 500mg PO q6h for 5-7 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7-10 days Topical 2% Mupirocin q8-12h for 5 days (Resistance to Mupirocin is on the rise)	References: NHS Wiltshire CCG,BaNES CCG & Swindon CCG Guidelines for Antibiotic Prescribing in the Community 2013-15 Topical fusidic acid is not recommended for inpatients
Ecthyma *S. pyogenes* Localised	Topical mupirocin 2% q8-12h for 7 days		Reference: Lippincott's Guide to Infectious Disease 2011
Ecthyma gangrenosum *Pseudomonas*	Antipseudomonal penicillin e.g Piperacillin **PLUS** Aminoglycosides **OR** Fluoroquinolones **OR** Antipseudomonal Cephalosporins **OR** *Aztreonam		Use in combination initially before sensitivity results available. *Requires DG aprroval References: DermNet NZ Update Dec 2013 Management of Ecthyma gangrenosum MedscapeUpdated june 2013

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Boils/Carbuncles ***S. aureus***	Cloxacillin 500mg PO q6h for 7-10 days	Erythromycin Ethylsuccinate 800mg PO q12h for 7-10 days **OR** Cefuroxime 500mg PO q12h for 7-10 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7-10 days	Surgical drainage is important in the management Reference: National Healthcare System UK 2013
Erysipelas ***Strep. pyogenes*** MRSA	Penicillin PO 500mg q6h >2 weeks **OR** Erythromycin Ethylsuccinate 800mg PO q12h for 10 days **OR** Cloxacillin 500mg PO q6h for 10 days If severe, Penicillin G IV 1.2MU q8h Vancomycin IV 1gm q12h	Cefazolin 1gm IV q8h **OR** Cephalexin 500mg PO q6h	Reference: Merck Manual 2013
Cellulitis *Staph. aureus* *Strep. pyogenes*	Penicillin 500mg PO q12h (outpatient) **OR** Cloxacillin 1gm IV q6h (inpatient) **OR** Amoxicillin 500mg PO q8h	Erythromycin Ethylsuccinate 800mg PO q12h Serious infection: Cefazolin 1gm IV q8h **OR** Cefuroxime 750mg IV q8h	Reference: Infectious Disease Society of America 2011 Change to oral once condition improves

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	OR Cephalexin 500mg PO q8h	**OR** Vancomycin 500mg IV q8h or 1gm q12h	
MRSA If CA-MRSA suspected	Vancomycin 15-20mg/kg IV q8-12h Clindamycin 300mg-450mg IV/PO q8h **OR** Doxycyline 100mg PO q12h	Linezolid 600mg IV/PO q12h	References: Infectious Disease Society of America 2011 Manual of Childhood infections (blue book)
Diabetic Foot Infections	Refer to Bone & Joint Infections Section		
Gas Gangrene/ Myonecrosis/ Necrotizing Fasciitis *Streptococci* *Clostridium* sp. Polymicrobial	Refer to Bone & Joint Infections Section		
Yaws *Treponema pertenue*	Benzathine Penicillin 1.2 MU IM single dose	Doxycycline 100mg PO q12h for 15 days **OR** Azithromycin 30mg/kg (max 2g)single dose **Penicillin Allergy:** Tetracycline 500mg PO q6h for 15 days **OR** Erythromycin Ethylsuccinate 800mg PO q12h for 15 days	References: WHO 2014 Lancet 2012

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Mycobacterial Infections			
Hansen's Disease (Leprosy) *Mycobacterium Leprae*	**Paucibacillary** Rifampicin 600mg PO monthly (supervised) **PLUS** Dapsone 100mg PO q24h Duration: 6 months (Completion of 6 doses within 9 months) Surveillance: 5 years **Multibacillary** Rifampicin 600mg PO monthly **PLUS** Clofazimine 300mg PO monthly **PLUS** Dapsone 100mg PO q24h **PLUS** Clofazimine 50mg PO q24h Duration: 1 year (if initial BI<4) or 2 years (if BI≥4) Completion of 12 doses within 18 months (BI<4) Completion of 24 doses within 36 months (BI≥4) Surveillance: **15 years**	**<u>Bacterial resistance or hypersensitivity to first line</u>** Can be substituted with one of the following: Minocycline 100mg PO q24h **OR** Ofloxacin 400mg PO q24h **OR** Clarithromycin 500mg PO q24h **OR** Ethionamide 250mg PO q24h	Remarks: Second line can only be initiated by a dermatologist References: Malaysian Clinical practice Guideline on Management of leprosy 2014 World Health Organisation Health Guidelines
Hansen's Disease (Leprosy) in HIV	Same as non HIV patients	Same as non HIV patients	
Atypical Mycobacterial Infections *Mycobacterium marinum*	Clarithromycin 500mg PO q12h **PLUS** Minocycline/ Doxycycline 100mg PO	Rifampicin 600mg PO q24h **PLUS** Ethambutol 15mg/kg PO q24h for	Often resistant to isoniazid

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	q12h **OR** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h At least 2 months of treatment until clearance	4-6 months, and continue for at least 1 month after lesions have been cleared **OR** Monotheraphy Doxycyline 100mg q12h for 1-2 months after lesion clearance (3-4 months)	References: ESPID Reports and Review : The Pediatric Infectious Disease Journal 2014 Rook Textbook Dermatology 4th edition(www.dermnetnz.org) Rook Textbook Dermatology 4th edition(www.dermnetnz.org)
Mycobacterium kansasii	Isoniazid 300mg PO q24h **PLUS** Rifampicin 600mg PO q24h **PLUS** Ethambutol 15mg/kg PO q24h for 18 months		
Mycobacterium ulcerans (Buruli ulcer)	Rifampicin 10mg/kg PO q24h **PLUS** Streptomycin 15mg/kg IM q24h for 8 weeks	Rifampicin 10mg/kg PO q24h **PLUS** Streptomycin 15mg/kg IM q24h for 4 weeks followed by Rifampicin 10mg/kg PO q24h **PLUS** Clarithromycin 7.5mg/kg PO q12h Doxycycline/ Minocycline 100mg PO q12h **PLUS** Clarithromycin 500mg PO q12h **OR** Imipenem 1gm IV q12h	Wide surgical excision and debridement are important Reference: *WHO 2014 **ESPID Reports and Review : The Pediatric Infectious Disease Journal 2014
Mycobacterium fortuitum/ chelonei	Rifampicin 10mg/kg PO q24h **PLUS** Clarithromycin 15mg/kg PO q12h for 8 weeks AntiTB therapy		Surgical debridement is necrotic tissue Reference: emedcine.medscape.com updated Nov 2012

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	OR Amikacin 15mg/kg IV q24h For 4-6 months, and continue for at least 1 month after lesions have been cleared		
Fungal Infections			
Tinea capitis *Trichophyton, Microsporum*	Griseofulvin 20-25mg/kg/24h (microsized) Griseofulvin 10-15mg/kg/day (ultramicrosized) PO **OR** Griseofulvin 500mg q12h or q24h for 6 to 12 weeks or longer till fungal cultures are negative **PLUS** 2.5% Selenium sulphide shampoo **OR** 2% ketoconazole shampoo , 2 – 3 times per week for 2 weeks	Terbinafine 250mg PO q24h **OR** Itraconazole 200mg PO q24h Duration is based on mycological agent: *Trichophyton* spp : 2-4 weeks *Microsporum* spp : 8-12 weeks	1)Kerion :Terbinafine 12-16 weeks 2) Contacts of patient may be treated with 2% ketoconazole shampoo 2 – 3 times per week for 2 weeks 3) Surgical excision is to be avoided Reference: Primary Care Dermatology Society UK 2013
Tinea barbae	Same as treatment of **Tinea capitis**		
Tinea corporis / Tinea cruris / Tinea faciei *Trichophyton,Microsporum, Epidermophyton* Mild infections:	Topical imidazole cream: Clotrimazole 1%		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Extensive infections:	**OR** Miconazole 2% **OR** Tioconazole 1% Duration: till clinical clearance with additional 2 weeks Griseofulvin 500mg PO q12h or q24h for 4-6 weeks	Terbinafine 250mg POq24h for 2 weeks **OR** Itraconazole 200mg PO q24h for 2 weeks	Reference: RxFiles Newsletter : Antifungal newsletter (April 2010) Canadian : Bugs and Drugs
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	Patients with contraindications to systemic agents may consider topical antifungal agents
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)	Amorolfine 5% Nail Lacquer weekly application For 6 months (finger nails) For 12 months (toe nails) **OR** Griseofulvin 500mg PO q12h For 6 months (finger nails) For 12 months (toe nails) **OR** Fluconazole 150mg PO once weekly 6-12 months for toenail	Amorolfine 5% Nail Lacquer is not indicated for children less than 12 years old Patients with contraindications to systemic agents may consider topical antifungal agents Reference: RxFiles Newsletter : Antifungal newsletter (April 2010) Canadian : Bugs and Drugs

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		≥3 months for fingernail	
Tinea versicolor *Malassezia Furfur* *Pityrosporum Orbiculare*	Selenium Sulphide 2% shampoo apply to affected areas 10 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 (recurrent cases)	Reference: Craig G Burkhart et al.Tinea Versicolor Treatment & Management.medscape. updated Dec 2013
Candidiasis *Candida albicans* Mild cutaneous candidiasis Extensive cutaneous candidiasis	 Topical Imidazole q12h till clear e.g. Miconazole 2% cream, Clotrimazole 1% cream, Tioconazole 1% cream Itraconazole 200mg PO q24h for 1 week	 Fluconazole 100mg PO q24h for 1 week (in severe and immunocompromised patients)	 Treatment of sexual partner is advisable in case of recurrent infection. Reference: RxFiles Newsletter : Antifungal newsletter (April 2010) Canadian : Bugs and Drugs
Subcutaneous Fungal Infections a. Sporotrichosis i. localized to skin only	 Itraconazole 200mg PO q24h for 3-6 months for at least 2-4 weeks after recovery. (max 200mg q12h, if no response) **OR** Terbinafine 250mg q24h/q12h	 Fluconazole 400-800mg q24h **OR** Potassium Iodide (saturated solution 50mg/drop) 5 drops q8h may increase to 40-50 drops q8h	 In some immunocompromised condition such as AIDS, longer treatment maybe necessary. Refer to Opportunistic Infections In HIV Patients Reference

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
ii.severe life threathening sporotrichosis b. Sporotrichosis In pregnancy	(max 500mg BD, if no response) Amphotericin B, (lipid formulation) 3–5mg/kg q24h, or Amphotericin B (deoxycholate), 0.7–1mg/kg q24h, Step down therapy: Itraconazole 6–10mg/kg (maximum of 400mg)PO q24h Localised hyperthermia		Clinical Practice Guidelines for the Management of Sporotrichosis: 2007 Update by the Infectious Diseases Society of America *Online library.wiley.com: Tebinafine 250mg daily Avoid azole in pregnancy
Histoplasmosis **Penicilliosis**	In immunocompetent, skin lesion may resolve spontaneously **In immunocompromised/ persistent symptom more than 1 month** Itraconazole 200mg PO q8h for 3 days, then q12h for 6-12 weeks **In less severe:** Itraconazole 200mg q8h for 3 days, then 200pg q12h for 12 weeks	(In ill patients initial therapy with IV Amphotericin B is preferred) **In severe case:** Amphotericin B IV 0.6-1mg/kg q24h for 2 weeks followed with Itraconazole 400mg q24h for 10 weeks	References: IDSA Guideline 2010 Clinical Practice Guidelines for the Management of Sporotrichosis: 2007 Update by the Infectious Diseases Society of America Emedicine.medscape.com November 2013 BMC Infectious Disease 2013 (BioMed Central)
Viral Infections			
Herpes Simplex Infections	Primary: Acyclovir 200-400mg PO 5 times daily for 5 days Recurrent: Regular normal saline dabs/gargle Immunosuppressed patients. Refer to chapter on HIV	Severe cases: Acyclovir 5mg/kg IV q8h for 5 days or until able to take orally, then change to oral	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Genitalia: *(Refer to Sexually Transmitted Infections-herpes genitalis)* **Eczema herpeticum:** Acyclovir 200mg PO 5 times daily for 7-10 days	Valacyclovir 500mg for 10 days (initial) If resistance: Valacyclovir 500mg for 5 days **OR** Roscarnet 40-60mg/kg for 10-15 days	References: Centers for Disease Control and Prevention (CDC) 2010 BASHH
Chickenpox Varicella zoster Immunocompetent Immunocompromised	Acyclovir 800mg PO 5 times daily for 7 days Acyclovir 10mg/kg IV q8h for 7 days (change to oral once there is an improvement)	Valacyclovir 1g q8h for 7days	Advisable to start treatment early within 48 hours Reference: Centers for Disease Control and Prevention (CDC) 2010
Herpes Zoster Varicella zoster	Acyclovir 800mg PO 5 times daily for 7days *	Valacyclovir 1g q8h for 7days	*Indicated in immunocompromised patients, herpes zoster ophthalmicus, Ramsay-Hunt syndrome and the elderly Involving face/genitalia Advisable to start treatment early within 48 hours

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Parasitic Infestations			
Scabies *Sarcoptes scabei* In pregnancy	Benzyl Benzoate emulsion 25% (EBB) apply from neck down and leave for 24 hours for 2 days Permethrin 5% lotion/cream apply and leave for 8 hours	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	Reference: Centers for Disease Control and Prevention (CDC) 2010 (updated 2013)
Head Lice *Pediculus humanus Capitis*	Gamma Benzene Hexachloride 0.1% (Lindane) apply and leave for 8 hours **OR** Malathion 1% shampoo	4% Dimeticone apply for 8hrs day 1 and day 7	Reference: Centers for Disease Control and Prevention (CDC) 2010
Body Lice/pubic Lice *Pediculus humanus*	Malathion lotion 0.5% for 8-12 hours and washed off **OR** Permethrin 1% cream apply to affected area for 10min and washed off		Reference: Centers for Disease Control and Prevention (CDC) 2010
Peripheral Thrombophlebitis Medium and advanced stage thrombophlebitis Early and advanced thrombophlebitis *Staph. aureus,* Coagulase negative *Staphylococcus,*	Remove the intravenous canulla and take blood culture Cloxacillin 500 mg PO q6h		Peripheral intravenous catheters with associated pain, induration, erythema, or exudate should be removed Any exudate at the insertion site should be submitted for Gram staining, routine culture, and additional culture for fungi and acid-fast organisms, as indicated, when assessing immunocompromised patients

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Gram negative rods			IDSA Guidelines for Intravascular Catheter-Related Infection • CID 2009:49

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 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h	Ampicillin/Sulbactam 1.5gm IV q6-8h **OR** Amoxycillin/Clavulanate 1.2gm IV q8h	Start upon diagnosis, discontinue after surgery
Perforated Appendix / Appendicular Mass	Metronidazole 500mg IV q8h **PLUS** Cefoperazone 1-2gm IV q12h	Ampicillin/Sulbactam 1.5gm IV q6-8h **OR** Amoxycillin/Clavulanate 1.2gm IV q8h	Duration 5-7 days
Perforated Viscus Peritonitis	Cefoperazone 2-4gm/day IV q12h **PLUS** Metronidazole 500mg IV q8h	Cefoperazone/Sulbactam 1-2gm q12h (max 8gm/day) **OR** Ampicillin/Sulbactam 1.5gm IV q6-8h **OR** Amoxycillin/Clavulanate 1.2gm IV q8h	
Abdominal trauma Suspected bowel or solid organ injury Gram negative enteric aerobes and anaerobes	Cefuroxime 1.5gm IV q8h **PLUS** Metronidazole 500mg IV q8h	Cefotaxime 1gm IV q8h **OR** Cefoperazone 1gm IV q12h **PLUS** Metronidazole 500mg IV q8h **OR**	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		Cefoperazone/Sulbactam 1gm IV q12h **OR** Ampicillin/Sulbactam 1.5gm IV q8h **OR** Amoxycillin/Clavulanate 1.2gm IV q8h	
Breast Abscess *Staph aureus*	Cloxacillin 1gm IV q6h	**Penicillin Allergy:** Clindamycin 600mg IV q8h	Drainage maybe required
Burn wound sepsis Likely organism: *S. pyogen,* *S. aureus* *Enterobacter* spp. *S. epidimidis* *E. faecalis* *P.aeruginosa*	Piperacillin/Tazobactam 4.5gm IV q6-8h	Cefepime 1 -2gm IV q8h	*Staph.aureus* tends to remain localized to burn wound, if toxic, consider toxic shock syndrome. *Candida sp* colonize seldom invade. Once C&S result back, antibiotic therapy should be based C&S result
VASCULAR			
Mycotic aneurysm Vascular prosthesis infection If colonized MRSA	Amoxycillin/Clavulanate 1.2gm IV q8h empirically, continue treatment based on C&S. Ceftazidime 1gm IV q8h if *Burkholderia pseudomallei /Salmonella* is suspected. Vancomycin 25mg/kg IV stat then 1gm q12h	Ampicillin/Sulbactam 1.5gm IV q8h empirically, continue treatment based on C&S **If allergy to Vancomycin or Vancomycin-resistant organism only:**	**Long term treatment:** Ciprofloxacin 250mg oral q12h **PLUS** Doxycycline 100 mg oral q12h (for melioidosis infection), CRP monitoring upon follow-up

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		IV Linezolid 600mg BD	
Ischaemic Ulcers with infection	Ampicillin/Sulbactam 1.5gm IV q8h for 7 days	Amoxycillin/Clavulanate 1.2gm IV q8h for 7 days	
BITES (penetrating injuries)			
Animal bite *S. aureus, Strep.*, Gram negative *Bacilli*, Anaerobes *Pasturella* (50% dog bites and 75% cat bites) *Eikenella* *Pseudomonas*	Amoxycillin/Clavulanate 625mg PO q8h	Doxycycline 100mg PO q12h **PLUS** Clindamycin 300mg PO q6h **If severe/life threatening**: Ampicillin/Sulbactam 1.5-3gm IV q6-8h **OR** Piperacilline/Tazobactam 4.5gm IV q8h	Prophylactic duration: 5 days -Associated crush injury -In the hands or proximity to a joint -Associated edema If infected: 10 days
Human bite *S. aureus,* Anaerobes, *Eikenella* *Strep.* (esp.*viridans)*	Amoxycillin/Clavulanate 625mg PO q8h for	**Penicillin Allergy:** Clindamycin 300mg PO q6h **PLUS** Ciprofloxacin 500-750mg PO q12h **OR** Trimethoprim/Sulphamethoxazole 160/800mg PO q12h	Surgical debridement if necessary Duration of treatment: 3-5 days
Reference: IDSA Practise Guideline, April 2014			
B. BONE AND JOINT INFECTIONS			
Vertebral Osteomyelitis (OM) **Epidural Abscess** >50 % of the cases are due to: *Staph aureus,* Enteric Gram negatives,	Cloxacillin 2gm IV q4h **OR** Ceftrixone 2gm IV q24h **OR** Cefepime 2gm IV q8h	**Penicillin Allergy:** Vancomycin 25mg/ kg IV loading dose, then 15mg/ kg IV q12h **PLUS/MINUS** Ciprofloxacin 400mg IV q8h Duration:	In the absence of bacteraemia, clinical stability or signs and symptoms of spinal cord compression. All antibiotic should be withheld till gram stain and culture result are available

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Group B *strep* (especially in DM)		Epidural abscess with no OM: 4-6 weeks Epidural abscess + vertebral OM: 6-12 weeks	Empiric gram negative should be covered if patient had recent spinal hardware inserted/ surgery, DM or recurrent UTI. Surgical therapy is necessary in progression of disease despite adequate antibiotic, spinal cord compression/spinal instability and/or presence of epidural abscess.
Septic Arthritis i. Acute monoarticular • **no STD risk (*Staph/Strep*)** • **STD risk (gonorrhea, *Strep/ Staph/* gram –ve bacili (GNB))** ii. Polyarticular *Gonorrhoae, burkholderia burgdorferi*, viral (Hep b) acute rheumatic fever	Cloxacillin 1-2gm IV q6h Ceftriaxone 2gm IV q24h **PLUS/MINUS** Azithromycin 1gm stat **OR** Doxycycline 100mg PO q12h for 7 days Ceftriaxone 2gm IV q24h	**Penicillin Allergy:** (immediate hypersensitive type) Clindamycin 600mg IV q6h, followed by oral therapy (same dose) **OR** Vancomycin 15-20mg/kg IV q12h Cefotaxime 1gm IV q8h Duration of Non STD GNB: 2-4 weeks Duration of STD septic arthritis: 1-2 weeks	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 Ceftriaxone 2gm IV q24h.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Consider MRSA in previously damaged joints/known MRSA infection/recent admission			
Reference: 1. G coakley. Rheumatology 2006;45: 1039-1041 2. Sandford guidelines 2013 3. Mathews CJ et al Lancet 2010 375(9717): 846 4. Johns Hopkins Antibiotic Guideline 2014			
Prosthetic Joint Infections: **MSSA** Intensive phase Maintenance phase **MRSA** Intensive therapy	 Cloxacillin 2gm IV q4-6h **OR** Cefazolin 2gm IV q8h **PLUS** Rifampicin 300-450mg PO q12h (usually 2-6 weeks) Ciprofloxacin 750mg PO q12h **OR** Timetoprim/Sulphametoxazole 5-10mg/kg q12h **PLUS** Fusidic acid 500mg IV q8h **PLUS** Rifampicin 300-450mg PO q12h Vancomycin 15-20mg/kg IV q12h **PLUS** Rifampicin 300-450mg PO q12h (usually 2-6 weeks)		Empiric therapy is NOT recommended. To treat base on C&S. Rifampicin should never be used alone or in bacteraemia. (The choice of de-escalation will depend on the sensitivity of the *Staph aureus*) Need to confirm sensitivity of antimicrobial agent prior to usage Reference: 1. Zimmerli et al. NEJM 2004; 14;351;1645. 2. Del Pozo JL. NEJM.2009 361(8): 787 3. Moran E. et al. J Antimicrobial Chemotherapy.2010; 65 4. Johns Hopkins Antibiotic Guideline 2014 Duration : 3 months for hip /6 months for knee

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Maintenance phase	Ciprofloxacin 750mg PO q12h **OR** Fusidic Acid 500mg PO q8h **PLUS** Rifampicin 300-450mg PO q12h		
OSTEOMYELITIS			
Acute Osteomyelitis *S. aureus* (80%), Group A *Strep pyogenes*, Rarely gram negative *bacilli*	**No open wound**: Cloxacillin 2gm IV q6h **If gram negative *bacilli* by on gram stain :** Ciprofloxacin 400mg IV q24h **OR** Ceftriaxone 2gm IV q24h	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 organism: *S. aureus*	Empirical treatment is not indicated Thorough Surgical debridement required (Removal of deadbone/ orthopaedic hardware) Choice of antibiotic depends on C&S result from tissue/bone		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.			
Mild Infections: a.Local infection involving skin & SC tissues	Cephalexin 500mg PO q6h **OR**	Clindamycin 300-450mg PO q8h **OR**	Duration:1-2 weeks

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
b.Erythema, less than 2 cm around the ulcer c.No systemic signs	Amoxycillin/Clavulanate 625mg PO q8h	Trimethoprim / Sulphametoxazole 5-10mg/kg PO q12h	
Moderate Infections: a. Deep tissue infection b. Erythema more than 2 cm around ulcer c. No SIRS If pseudomonas is suspected	Ampicillin/Sulbactam 1.5-3gm IV q6-8h **OR** Ceftriaxone 1-2gm q24h **PLUS/MINUS** Metronidazole 500mg IV q8h Piperacillin/Tazobactam 4.5mg IV q6-8h	Ciprofloxacin 400mg IV q8-12h **PLUS** Clindamycin 600mg IV q8h	Duration: usually 2-4 weeks. Modify according to clinical response. If proven osteomyelitis: at least 4-6 weeks. However, a shorter duration (3 to 5 days) is sufficient if the entire infected bone is removed. If antibiotic-resistant organisms are likely, treat as severe infection.
Severe Infections: All of the above 2 or more SIRS	Piperacillin/Tazobactam 4.5gm IV q6-8h	Cefepime 1-2gm IV q8h	Add Vancomycin 1gm IV q12h, if high risk for MRSA Duration of treatment: 4-6 weeks
Necrotizing Fasciitis			
Polymicrobial infection. Primarily occurs in patients who are immunocompromised or have certain chronic diseases such as diabetes Group A *strep*	Piperacillin/Tazobactam 4.5gm IV q8h Benzylpenicillin 2-4MU IV q4h **PLUS**	Cefotaxime 2gm IV q6h **PLUS** Metronidazole 500mg IV q8h Ampicillin/Sulbactam 1.5gm IV q8h **PLUS** Clindamycin 600-900mg IV q8h	Add Vancomycin 1gm IV q12h, if high risk for MRSA Early aggressive surgical debridement essential With septicemia/ severely refer to ICU guideline Reference: 1. Lipsky BA et.al. Arch Internal

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Clindamycin 600-900mg IV q8h		meds 1990: 150: 790-7 2. IDSA guideline. CID 2012:54 3. Dowd SE et al. Plos one 2008; 3:e3326
Fournier's Gangrene *E.coli,* *Klebsiella,* *Proteus,* *Enterococcus, Pseudomonas,* Anaerobes	Cefoperazone 1gm IV q12h **PLUS** Metronidazole 500mg IV q8h	Cefoperazone/Sulbactam 1gm IV q12h **PLUS** Metronidazole 500mg IV q8h **OR** Piperacillin/Tazobactam 4.5gm IV q8h	Aggressive surgical debridement is necessary to remove all necrotic tissue. Reference: Ju Wang et. Pak J Med Sci 2011: Vol 27, No 1.
Soft Tissue Infection Secondary To Gas Producing Organism			
Clostridium spp, Gram –ve organism	Benzylpenicillin 2-4MU IV q4h **PLUS** Clindamycin 600-900mg IV q6h **PLUS/MINUS** Gentamicin 5mg/kg IV q24h Duration: 10 – 28 days	Cefotaxime 2-4gm IV q8h **PLUS** Clindamycin 600-900mg IV q6h **PLUS/MINUS** Gentamicin 5mg/kg IV q24h Duration: 10 – 28 days	*For *Clostridium* sp.: Benzylpenicillin 4MU IV q6h is preferred Early aggressive surgical debridement is essential *Reference:* *Johns Hopkins Antibiotic Guideline, 2014*
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 5mg/kg IV q24h **OR**		Change antibiotics accordingly after C&S result are available Topical antibiotics are not recommended for treatment of wound infections as it may result in the emergence of resistant organisms Patient tetanus immunization status

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	As a monotherapy: Cefuroxime 1.5gm IV q8h		should be assessed in all cases
Muscular, Skeletal and Soft Tissue Trauma, Crush Injuries and Stab Wounds			
Muscular, skeletal and soft tissue trauma, crush injuries and stab wounds	Cloxacillin 2gm IV q6h **PLUS** Gentamicin 5mg/kg IV q24h **PLUS** Metronidazole 500mg IV q8h Duration: Not less than 5 days	Cefuroxime 1.5gm 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/ortendons, antibiotics must be given for at least **5 days**
Compound Fractures			
Compound fractures Mostly nosocomial and gram positive Need MRSA empirical cover if local prevalence is high	Cefazolin 1gm IV q8h **PLUS/MINUS** Gentamicin 5mg/kg IV q24h Duration: 24 hrs after wound closure or up to 5- 10 days		Add Gentamicin if wound soiling or tissue damage is severe and/or devitalized tissue is present: Pre-debridement and post debridement cultures are not representative of actual infection Reference: 1. Mark L Prasarn. Am j Orthop. 2009;38(11): 559 2. Kanu Okike et al.. J Bone Joint Surg Am. 2006 Dec;88(12):2739-48. 3. M Griffin et. Open Orthop J. 2012.
C. UROLOGY			
Pyonephrosis/ Perinephric Abscess *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Amoxycillin/Clavulanate 1.2gm IV q8h **PLUS** Gentamicin 5mg/kg IV q24h **OR** Cefoperazone 1gm IV q12h	Ciprofloxacin 200-400mg IV q12h	**PLUS** Drainage followed by definitive surgery

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Renal Abscess *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas, Staph Aureus*	Ampicillin/Sulbactam 1.5gm IV q8h followed by 375mg PO q12h **OR** Cefuroxime 750- 1500mg IV q8h followed by 250mg PO q12h **PLUS/MINUS** Gentamicin 5mg/kg IV q24h (min 2 weeks)	Ceftriaxone 1-2gm IV q24h	Drainage may be required. Commence oral after temperature settled
Acute Prostatitis *E. coli* *Staph. saprophyticus, Enterococus, Enterobacteriacie, Proteus*	**If ill and hospitalized**: Ciprofloxacin 200mg IV q12h **PLUS/MINUS** Gentamicin 5mg/kg IV q24h **Less severe infection**: Ciprofloxacin 500mg PO q12h	Cefoperazone 1g IV q12h Trimethoprim/Sulfamethoxazole 160/800mg PO q12h **OR** Doxycycline 100mg PO q12h	Treatment for 2-4 weeks
Chronic Bacterial Prostatitis (CPPS NIH Type II) Mostly culture negative	Ciprofloxacin 500mg PO q12h for 2 weeks	Trimethoprim/ Sulfamethoxazole 160/800mg PO q24h for 2 weeks	Pending positive culture on prostatic secretion To assess response after 2 weeks. If beneficial, to continue for 4-6 weeks
Prostatic Abscess *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Ciprofloxacin 200-400mg IV q12h followed by 500mg PO q12h minimum of 2-4 weeks	Cefoperazone 1gm IV q12h followed by, Cefuroxime 500mg PO q12h minimum of 2-4 weeks	Drainage mandatory
Non Gonoccocal Urethritis	Refer to Sexually Transmitted Infections Section		
Epididymo-orchitis *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Ciprofloxacin 500mg PO q12h minimum of 2 weeks		Consider sexually transmitted pathogens in sexually active men – Refer to Sexually Transmitted Infections Section

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Testicular Abscess *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Amoxycillin/Clavulanate 1.2gm IV q8h **OR** Ampicillin/Sulbactam 1.5gm IV q8h	Cefoperazone 1gm IV q12h	**PLUS** drainage
Fournier's Gangrene	Refer to Page Necrotizing Fasciitis Section		
Urosepsis (Septicaemia post urological instrumentation or urological infections) *E. coli, Klebsiella, Proteus, Enterococcus, Pseudomonas*	Cefepime 1g IV q12h **OR** Imipenem/Cilastatin 500mg IV q8h	Cefoperazone/Sulbactam 1gm IV q12h	Choice of antibiotics should be adapted based upon culture results
D. NEUROSURGERY			
Cranial Trauma Open fracture & Penetrating injuries Closed fracture	As per Neurosurgical Procedure for Contaminated condition Refer to Chemoprophylaxis Section Antibiotic not required	 Antibiotic not required	
Skull base fracture without CSF fistula	Antibiotic not required	Antibiotic not required	
Skull base fracture with CSF fistula	As per Penetrating injuries		Duration : 5-10 days Refer neurosurgery if fistula persist for more than 1 week
Skull fracture with pneumocranium	As per Penetrating injuries		
Brain abscess	As per Neurosurgical Procedure for Dirty Condition Refer to Chemoprophylaxis Section		To screen for immunocompromised conditions

References:
1. Am J Health-Syst Pharm Vol 70 Feb 1, 2013
2. Scottish Intercollegiate Guidelines Network. Antibiotic prophylaxis in surgery. www.sign.ac.uk/pdf/sign104.pdf (accessed Nov 2014)
3. Nottingham Antibiotic Guidelines Committee, January 2014

4. National Institute for Health and Clinical Excellence. Surgical site infection (clinical guideline 74) 2008. www.nice.org.uk/CG74 (accessed Nov 2014).
5. Tunkel, et al. Practice Guidelines for the Management of Bacterial Meningitis. Clin Inf Dis 2004; 39:1267-84.

TROPICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
1. Typhoid Fever			
Salmonella Typhi Stable Case Fully sensitive	Pefloxacin 400mg PO q12h for 5-7 days **OR** Ciprofloxacin 500mg PO q12h for 5-7 days **OR** Ofloxacin 400mg PO q12h for 5 -7 days	Amoxycillin 75 – 100mg/kg/day PO in 3-4 divided doses for 14 days **OR** Trimethoprim/ Sulfamethoxazole 160/800mg PO q12h for 14 days	Fever clearance is faster with Quinolones Reference: WHO, 2003 Parry CM et al. Typhoid fever. N Engl J Med 2002; 347:1770.
Quinolone resistance	Ceftriaxone 60mg/kg/day for 10-14 days	Azithromycin 500mg PO q24h for 7 days	Reference: WHO, 2003
Unstable or complicated cases	Ceftriaxone 60mg/kg/day for 10-14 days **OR** Ciprofloxacin 400mg IV q12h for 10-14 days		Indication of dexamethasone: (discuss with physician) i) Typhoid psychosis ii) Septic shock Dose: 3mg/kg loading, then 1mg/kg q6h for 2 days Reference: WHO, 2003 Paed. Inf. Dis J,1988
2. Cholera			
Vibrio cholerae Non Tetracycline resistance	Doxycycline 300mg PO stat (once patient can take orally)	Ciprofloxacin 1gm PO stat	Principle of Treatment: i) Rehydration ORS if tolerating orally ii) Monitor urine output iii) Avoid antidiarrhoea agents -

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Tetracycline resistance	Erythromycin Ethylsuccinate 800mg PO q12h for 3 days **OR** Azithromycin 1gm PO stat	Ciprofloxacin 1gm PO stat	Diphenoxylate HCL/Atropine Sulphate (Lomotil) or Loperamide HCL (Imodium) Reference: WHO Global Task on Cholera Control 2004 Saha D et al. Single-dose azithromycin for the treatment of cholera in adults. N Engl J Med 2006; 354:2452.
3. Scrub Typhus			
Orientia tsutsugamushi (*rickettsia tsutsugamushi)* Tetracycline sensitive	Doxycycline 100mg PO q12h for 3-7 days	Azithromycin 500mg PO stat‡	‡ Recommended alternative for pregnant woman Reference: CID 2004 Nov 1; 39(9):1329-35
4. Brucellosis			
B. melitensis, *B. abortus, B. suis and B. canis*	Streptomycin 1gm (15mg/kg) IM q24h for 2 - 3 weeks **PLUS** Doxycycline PO 100mg q12h for 6 weeks **OR** Doxycycline 100mg PO q12h for 6 weeks **PLUS** Rifampicin 600-900mg (15mg/kg) PO q24h for 6 weeks	Doxycycline 100mg PO q12h for 6 weeks PLUS Gentamicin 5mg/kg/24h IV for 7 days OR Rifampicin 600-900mg (15mg/kg) PO q24h for 6 weeks‡ PLUS Trimethoprim/ Sulfamethoxazole 160/800mg PO q12h for 6 weeks‡	Longer duration (up to 12 weeks) maybe required in spodylitis, neurobrusellosis, IE, localized suppurated lesions ‡ Recommended alternative for pregnant woman Reference: CPG Brucellosis, MOH 2012 Ariza J et al. Perspectives for the treatment of brucellosis in the 21st century: the Ioannina recommendations. PLoS Med 2007; 4:e317. Mandell, Douglas & Bennett's Principles & Practice of Infectioius Diseases. 8th Edition

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
5. Leptospirosis			
Leptospira sp. Severe disease (Leptospiral pulmonary syndrome, multiorgan involvement, sepsis)	Benzylpenicillin 2MU IV q6h for 5-7 days	Ceftriaxone 1-2gm IV q24h **OR** Cefotaxime 1gm IV q8h for 7 days	Jarisch-Herxheimer reaction may occur upon initiation of antimicrobial Reference: CPG Leptosiprosis, MOH 2011 Clin Infect Dis 2003; 36:1507-1513 Clin Infect Dis 2004; 39:1417-1424
Mild to Moderate disease	Doxycycline 100mg PO q12h for 5-7 days	Azithromycin 500mg PO q24h for 3 days	Reference: Phimda K et al. Doxycycline versus azithromycin for treatment of leptospirosis and scrub typhus. Antimicrob Agents Chemother 2007; 51:3259.
6. Tetanus			
Clostridium tetani	Metronidazole 500mg IV q6h-q8h for 7-10 days	Benzylpenicillin 2MU IV q6h for 7-10 days	
	Human Tetanus Immunoglobulin 3000- 6000 units IM stat At a different site initiate age appropriate active immunization		All patients with tetanus should undergo wound debridement to eradicate spores and necrotic tissue
7. Melioidosis			
Burkholderia pseudomallei Intensive/Induction Therapy	Ceftazidime 100-200mg/kg/24h IV q8h (usual dose : 2gm q8h) **PLUS/MINUS** Trimethoprim/ Sulfamethoxazole 8/40mg/kg/24h IV/PO in divided doses	Meropenem 25mg/kg/24h IV q8h (usual dose: 1gm q8h; if CNS infection 2gm q8h) **OR** Imipenem 50-60mg/kg/24h IV q6h (usual dose: 1gm q6h)	Consider to add on Trimethoprim/ Sulfamethoxazole neurologic, prostatic, bone, joint, cutaneous, and soft tissue melioidosis To consider G-CSF for severe cases within 72 hours of admission

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Duration: 2 - 3 weeks 4 - 8 weeks if severe/ deep focal infection	**PLUS/MINUS** Trimethoprim/ Sulfamethoxazole 8/40mg/kg/24h IV/PO in divided doses Duration: 2 - 3 weeks 4 - 8 weeks if severe/ deep focal infection	Look for source of infection Folic Acid 5mg PO q24h to be given for patient on Trimethoprim/ Sulfamethoxazole
Eradication/Maintenance Therapy	Trimethoprim/ Sulfamethoxazole < 40 kg: 160/800mg q12h; 40-60kg:240/1200mg q12h; >60kg:320/1600mg q12h Duration: minimum 3 months	Amoxycillin/Clavulanate 1250mg (2 tabs of 625mg) PO q8h **OR** Doxycycline 100mg PO q12h or 200mg PO q24h Duration: minimum 3 months In patients with neurological or osteomyelitis up to 6 months treatment is recommended.	<u>Reference</u>: CPG Melioidosis Pahang 2011 Inglis TJJ. The treatment of melioidosis. Pharmaceuticals 2010;3:1296-1303 Bart Currie, Nicholas Anstey, Treatment & Prognosis of Melioidosis, Wolters Kluwer Health.

8. Malaria

WHO recommends the use of Artemisinin Combination Therapy (ACT) as the standard treatment for malaria and discourages the prescription of monotherapy or sub-standard ACT as this will promote resistant.

<u>Features of severe/complicated Malaria includes at least one of the following clinical or laboratory features:</u>

<u>Clinical manifestation:</u>

Impaired consciousness or unrousable coma
Prostration (generalized weakness so that the patient is unable to walk or sit up without assistance)
Failure to feed/ not tolerating orally
Convulsion
Deep breathing, respiratory distress (acidotic breathing)
Circulatory collapse or shock

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Clinical jaundice and evidence of other vital organ dysfunction Haemoglobinuria Abnormal spontaneous bleeding Pulmonary oedema (radiological) **<u>Laboratory test:</u>** Hypoglycaemia, metabolic acidosis, severe normocytic anaemia, haemoglobinuria, hyperparasitaemia, hyperlactataemia or renal impairment. Reference: CPG Malaria, MOH 2013, WHO Guideline on Treatment of Malaria 2010 and WHO A Practical Handbook: Management of Severe Malaria 2012			
Plasmodium falciparum a) Non Complicated i) New Infection	Riamet® (1 tablet: Artemether/ lumefantrine 20/120mg) The patient should receive an initial dose, followed by 2nd dose 8 hours later, then 1 dose q12h for the following 2 days <15kg : 1 tab per dose 15 - <25kg: 2 tab per dose 25 - <35kg: 3 tab per dose ≥35kg : 4 tab per dose	Artesunate /Mefloquine 5 - 8kg : 25/55mg PO q24h 9 - 17kg : 50/110mg PO q24h 18 - 29kg: 100/220mg PO q24h ≥30kg : 200/440mg PO q24h for 3 days **OR** Quinine 10mg/kg PO q8h **PLUS** Doxycycline 100mg PO q12h for 7 days **OR** Quinine 10mg/kg PO q8h **PLUS** ǂ Clindamycin 600mg PO q12h for 7 days	Artesunate /Mefloquine available as FDC tablet: 25/55mg and 100/220mg Primaquine 0.75mg/kg (max: 45mg) to be given on Day 1 as a single dose except in pregnant/lactating woman (check G6PD status before use). ǂ Pregnancy: Limited data on safety of artemisinin given during 1st trimester. Exposure of artemisinin derivatives during 2nd and 3rd trimester has shown no adverse effects on the mother or foetus. Thus, quinine and clindamycin is recommended.
Plasmodium falciparum a) Non Complicated ii) Treatment failure or relapse	An alternative ACT regimen to be used. (eg: If Riamet® is used as the first	Quinine 10mg/kg PO q8h **PLUS** ǂ Doxycycline 100mg PO q12h for 7	Mefloquine should not be repeated within 60 days of first treatment due to increased risk of

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	line regimen, so the choice will be Artesunate /Mefloquine and vice versa) Refer above for dosing	days	neuropsychiatric side effects.
Plasmodium falciparum b) Complicated (see definition above)	Artesunate 2.4mg/kg IV at 0 hour, 12 hour, 24 hour and q24h till day 7* **PLUS/MINUS** Doxycycline 100mg PO q12h for 7 days	Loading dose Quinine 20mg/kg IV over 4 hours in D5% on day 1, then Quinine 10mg/kg IV/PO q8h **PLUS** Doxycycline 100mg PO q12h for 7 days **OR** Quinine 7mg/kg IV over 1 hour, followed by 10mg/kg in D5% over 4 hours on day 1, then Quinine 10mg/kg IV/PO q8h **PLUS** Doxycycline 100mg PO q12h for 7 days	*Parenteral artesunate should be given for a minimum of 24 hours (3 doses) or until patient can tolerate orally then it can be switched to a complete course of oral ACT regime, eg: Riamet® or Artesunate/Mefloquine. Monitor patient's blood glucose and ECG while on IV quinine Pregnancy: Artesunate IV as for normal adults
Plasmodium vivax/ovale a) New infection	Chloroquine 10mg/kg (max 600mg) PO stat, then 5mg/kg (max 300mg) 6 hours later, followed by q24h for 2 days **PLUS** Primaquine 0.5mg/kg (max 30mg) PO q24h for 14 days		G6PD deficiency: Primaquine 0.75mg/kg PO q7d for 8 weeks. If significant haemolysis occurs, should be stopped. Pregnancy: Full course chloroquine to be given, followed by 300mg q7d till delivery. Full course of primaquine only to be given post-delivery.
Plasmodium vivax/ovale b) Treatment failure or suspected chloroquine resistance	Riamet® (dosing as per *Plasmodium falciparum treatment*) **PLUS**		If severe *P.vivax*, treatment is as complicated *P.Falciparum.*

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Primaquine 0.5mg/kg (max 30mg) PO q24h for 14 days		
Plasmodium malariae/ knowlesi	Riamet® (dosing as per Plasmodium falciparum	Artesunate /Mefloquine (dosing as per *Plasmodium falciparum* treatment) **OR** Chloroquine 10mg/kg (max 600mg) PO stat, then 5mg/kg (max 300mg) 6 hours later, followed by q24h for 2 days	If severe *P.malariae/knowlesi*, treatment is as complicated *P.Falciparum.*
Mixed Infection	Treat as *Plasmodium falciparum*		
Chemoprophylaxis	Doxcycline 100mg PO q24h Start: 1-2 days before departure Stop: 4 weeks after travel Max duration: 2 years **OR** Atovaquone/proguanil (Malarone®)* 100/250mg q24h Start: 1-2 days before departure Stop: 7 days after travel	Mefloquine 250mg PO q7d Start: 2 weeks before departure Stop: 4 weeks after travel Max duration: 1 year	Pregnancy: Only melfoquine can be used Refer to the drug resistance pattern and recommended prophylaxis in the travelling destination. *Requires DG approval

TUBERCULOSIS INFECTIONS

(Adapted from the Clinical Practice Guidelines For The Management of Tuberculosis, Ministry of Health Malaysia,3rd edition 2012)

1. Drugs

1.1 First-line AntiTB Drugs

Drug	Recommended Dose			
	Daily		3 times/week	
	Dose (range) in mg/kg	Max/day in mg	Dose (range) in mg/kg	Max/day in mg
Isoniazid (H)*	5 (4 - 6)	300	10 (8 - 12)	900
Rifampicin (R)	10 (8 - 12)	600	10 (8 - 12)	600
Pyrazinamide (Z)	25 (20 - 30)	2000	35 (30 - 40)**	3000**
Ethambutol (E)	15 (15 - 20)	1600	30 (25 - 35)**	2400**
Streptomycin (S)	15 (12 -18)	1000	15 (12 - 18)**	1500**

*Pyridoxine 10 – 50mg/day needs to be added.
**Daily treatment is the preferred regimen.

1.2 Fixed-Dose Combination (FDC) Dosing

The two FDCs available in MoH Drug Formulary for adults are:-
(i) 4-Drug FDC : Isoniazid 75mg, Rifampicin 15 mg, Pyrazinamide 400mg and Ethambutol 275mg tablet
(ii) 3-Drug FDC: Isoniazid 75mg, Rifampicin 150mg and Pyrazinamide 400mg tablet

The recommended dosages for the two FDCs are:

Body weight (kg)	Recommended dose
30 - 37	2 tabs daily
38 - 54	3 tabs daily
55 - 70	4 tabs daily
>70	5 tabs daily

*Pyridoxine 10 – 50mg/day needs to be added.

1.3 Second-line AntiTB Drugs

Drug	Route	Recommended Dose		
		Dose (range) in mg/kg	Max/day in mg	Frequency
Kanamycin	IV	15 - 20	1000	OD
Amikacin	IV	15 - 20	1000	OD
Ethionamide	PO	15 - 20	1000	OD
p-aminosalicylic acid (PAS)*	PO	150	12 000	2 -3 equally divided doses
Capreomycin*	IV	15 - 20	1000	OD
Cycloserine**	PO	15 - 20	1000	BD
Clofazimine	PO	100 – 300mg/day	300	OD
Ofloxacin	PO	15 - 20	1000	BD (commonly given as 400mg BD)

Levofloxacin	PO	7.5 - 10	1000	OD (commonly given as 750mg OD)
Moxifloxacin	IV/PO	7.5 - 10	400	OD

* Requires DG approval
**Pyridoxine 50mg needs to be added for every 250mg of cycloserine.

2. Treatment regimens

Treatment regimens are divided into:
(i) Initial or intensive phase.
(ii) Continuation or maintenance phase.

2.1 New Case of Pulmonary Tuberculosis (PTB)

- New patients with pulmonary tuberculosis should receive daily 2EHRZ* (2 months of intensive phase), followed by daily 4HR* (4 months of maintenance phase).
- Regimen should contain six months of rifampicin.
- Rifampicin should be rounded to higher recommended dose if tolerated.
- If ethambutol is contraindicated, streptomycin can be substituted

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

2.2 Treatment of Previously Treated Cases

- Previously treated TB patients include those patients treated as new cases who have taken treatment for more than one month and are currently smear or culture positive again (i.e. failure, relapse or return after default).
- Drug sensitivity test (DST) must be done for the patients. When the results become available, the drug regimen should be adjusted appropriately.
- Physician with experience in TB management should be consulted for all patients requiring retreatment of TB.

2.3 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.
- All extrapulmonary tuberculosis should be treated with antiTB for a minimum of 6 months except for bone (including spine) and joint tuberculosis for 6 - 9 months and tuberculous meningitis for 9 - 12 months.
- Streptomycin should be used instead of ethambutol in adult TB meningitis.
- Steroids should be given in tuberculous meningitis or pericarditis.

2.4 Multi-Drug Resistant Tuberculosis (MDR-TB)

- MDR-TB is defined as *Mycobacterium tuberculosis* infection resistant to both isoniazid and rifampicin with or without resistance to other drugs.
- Extensively drug-resistant tuberculosis (XDR-TB) is when the *Mycobacterium tuberculosis* is resistance to isoniazid and rifampicin plus resistance to quinolones and at least one second-line aminoglycosides.
- Newly MDR-TB (i.e. not previously treated for MDR-TB), total treatment duration is 20 months for most patients.

- Treatment usually consist of
    - Fluoroquinolone
    - Ethionamide
    - A parenteral agent
    - Pyrazinamide
    - Cycloserine or PAS (if cycloserine cannot be used)

3. Management of Tuberculosis in Special Situations

3.1 Tuberculosis during pregnancy and lactation

- First-line antiTB drugs except streptomycin are safe for pregnancy and lactation.
- Standard treatment using Isoniazid, Rifampicin, Pyrazinamide and Ethambutol is used.
- Streptomycin should be avoided in pregnancy due to foetal ototoxicity.
- Pyridoxine (25mg daily) should be given to all pregnant/lactating women on isoniazid to prevent foetal neurotoxicity.
- Once active TB in the baby is ruled out, the baby should be given six months isoniazid prophylaxis, followed by BCG vaccination.

3.2 Tuberculosis and use of oral contraceptive pill

- Rifamycin drugs such as rifampicin and rifabutin reduce the contraceptive efficacy of both combined oral contraceptives and progesterone-only pills.
- Alternative contraception methods are recommended during rifampicin therapy and also up-to one month stopping the therapy even if it has been administered for less than a week.

3.3 Tuberculosis in patients with liver impairment

- If baseline ALT is more than three times upper limit of normal before the initiation of treatment, one of the following antiTB regimens should be considered.
    - Two hepatotoxic drugs: 9HRE or 2SHRE/6HR
    - One hepatotoxic drug : 2SHE/10HE
    - No hepatotoxic drug :18 - 24 months of streptomycin, ethambutol and fluoroquinolones.
- The more unstable or severe the liver disease, the fewer hepatotoxic drugs should be used.
- Regular monitoring of liver enzymes should be performed in patients with pre-existing liver disease or at risk of drug-induced hepatitis.

3.4 Tuberculosis in patients with renal impairment

- Frequency of pyrazinamide and ethambutol should be adjusted.
- Streptomycin should be avoided if possible.
- The usual regime is $2E_3HRZ_3/4HR$. (The subscript indicates number of doses per week)

3.5 Tuberculosis-HIV Co-Infection

- AntiTB regimen offered to HIV-positive adults should be the same as for HIV-negative adults.
- Daily treatment should be offered in the maintenance phase.
- Minimum duration of antiTB in HIV-infected adults is 6 months in PTB and 6 -12 months in extrapulmonary TB.

- The timing of initiation of HAART in TB patients depends on the type of TB and CD4 counts.

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*	Nitrofurantoin 50mg PO q6h for 3 days	Amoxycillin/Clavulanate 625mg PO q8h for 3 days **OR** Cefuroxime 250mg PO q12h for 3 days	The choice of agents should be based on local culture and susceptibility results Nitrofurantoin should be used with caution in elderly and is contraindicated if GFR < 40 ml/min Duration of treatment should be up to 7 days in male
Acute Cystitis in Pregnancy	Nitrofurantoin 50mg PO q6h for 7 days **OR** Cefuroxime 250mg PO q12hr for 7 days	Cephalexin 500mg PO q12h for 7 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7 days	The choice of agents should be based on local culture and susceptibility results Avoid trimethoprim in pregnancy
Recurrent Urinary Tract Infections Prophylaxis: >3 episodes/year	Nitrofurantoin 50mg PO nocte for 3-12months **OR** Trimethoprim 100mg PO nocte for 3-12months	Trimethoprim/Sulphamethoxazole 80/400mg PO nocte for 3-12months **OR** Cephalexin250mgPO ON for 3-12months	
Acute Uncomplicated Pyelonephritis *E.coli, Enterobacter, Proteus* *Pseudomonas* For patients not requiring	Ciprofloxacin 500mg PO q12hrs	Amoxycillin/Clavulanate 625mg PO	The choice of agents should be based on local culture and susceptibility results May step down to oral antibiotic following clinical improvement

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
hospitalization For patients requiring hospitalization	for 7 days with/ without an initial Ciprofloxacin 400mg stat IV Ceftriaxone 1-2gm q24h IV for 14 days with/without aminoglycoside. **OR** Amoxycillin/Clavulanate 1.2gm IV q8h for 14 days	q8h for 14 days Ciprofloxacin 400mg IV q12h for 7 days	(afebrile for 48 hours)
Acute Complicated Pyelonephritis	Refer to Surgical Infections Section		
Acute Pyelonephritis in Pregnancy	Cefuroxime 750mg IV q8h for 14 days	Amoxycillin/Clavulanate 1.2gm IV q8h for 14 days **OR** Ceftriaxone 1-2gm IV q24h for 14 days	Avoid trimethoprim and fluoroquinolones in pregnancy
Asymptomatic Bacteriuria Recommendation for treatment is only for the following conditions:- a) Pregnant women if test results are positive (refer to Asymptomatic Bacteriuria in Pregnancy) b) Patients who undergo traumatic urologic interventions with mucosal bleeding,and such patients should be treated prior to such interventions	Trimethoprim 100mg PO q12hr for 7 days or 300mg PO q24h for 7 days **OR** Nitrofurantoin 50mg PO q6h for 7 days	Cefuroxime 250mg PO q12h for 7days	The choice of agents should be based on local culture and susceptibility results Avoid trimethoprim in pregnancy

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
c) Before transurethral resection of the prostate d) Before renal transplant or early post-operative period			
Asymptomatic Bacteriuria in Pregnancy	Nitrofurantoin 50mg PO q6h for 7 days **OR** Cefuroxime 250mg PO q12hr for 7 days	Cephalexin 500mg PO q12h for 7 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7 days	Avoid trimethoprim and fluoroquinolones in pregnancy
Catheter Related Bacteriuria	Antibiotics not recommended for asymptomatic bacteriuria with indwelling urethral catheter		Remove or change catheter if possible. Only consider antimicrobial treatment if bacteriuria persists 48hrs after catheter removal
CAPD Peritonitis *Staph aureus* CoNS *Pseudomonas aeruginosa* Enteric gram negatives	Intra peritoneal Cefazolin 15 mg/kg per bag once daily **PLUS** Intra peritoneal Ceftazidime 1-1.5gm per bag once daily	If patient has been colonized with MRSA or is in clinical sepsis or has hypersensitivity to cephalosporins, Vancomycin can replace Cefazolin at 15-30 mg/kg every 5-7 days For hypersensitivity to Cephalosporins, Ceftazidime can be replaced with Gentamycin 0.6 mg/kg per bag once daily	Consider adding the same intravenous antibiotics on top of intraperitoneal antibiotics in severely ill patients. If possible, centrifuge removed dialysis fluid – gram stain and culture directly into blood culture bottle. . If multiple enteric gram negatives are grown, consider bowel perforation and removing catheter. Also consider catheter removal in relapsing or refractory peritonitis; refractory exit or tunnel infection and for fungal peritonitis.

References:
1. The Sanford Guide To Antimicrobial Therapy 2011
2. Guidelines on Urological Infections, European Association of Urology 2014
3. IDSA Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults 2005
4. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the IDSA and European Society for Microbiology and Infectious Diseases 2011.
5. Sanford, Australian therapeutic guidelines on antibiotics

SECTION B
PEADIATRICS

CARDIOVASCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
1. Acute Myocarditis			
Commonly caused by viruses	Treatment mainly supportive		
2. Acute pericarditis			
Viral (commonest cause) Bacterial: *Staphylococcus aureus*	Treatment mainly supportive Cloxacillin 200 mg/kg/24h IV q4-6h for 6 weeks **PLUS/MINUS** Gentamicin 1 mg/kg IV/IM q8h for 3 -5 days	**Penicillin Allergic:** Cefazolin 100 mg/kg/24h IV q8h **OR** Vancomycin 40 mg/kg/24h IV in 2-4 divided doses	Consider surgical drainage if pericardial empyema detected
3. Infective Endocarditis			
Empirical Therapy for Infective Endocarditis	Benzylpenicillin 200,000 units/kg/24h IV q4-6h for 4 weeks **PLUS** Gentamicin 1 mg/kg IV/IM q8h for 2 weeks	Vancomycin 15 mg/kg q12h IV for 4-6 weeks **PLUS** Gentamicin 1 mg/kg IV/IM q8h for 2 weeks	
Infective Endocarditis *Streptococcus viridans* Strains fully susceptible to penicillin (MIC < 0.125 mg/l)	Benzylpenicillin 200,000 units/kg/24h IV q4-6h for 4 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 2 weeks	Ceftriaxone 100mg/kg IV/IM q24h for 4 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 2 weeks **Penicillin/Ceftriaxone Allergic:** Vancomycin 40mg/kg/24h IV q8-12h for 4 weeks	Dosages suggested are for patients with normal renal and hepatic function. Maximum dosages per 24 hours: Penicillin 18 MU; Ampicillin 12gm; Ceftriaxone 4gm, Gentamicin 240 mg. Vancomycin dose adjusted for trough concentration of 15-20

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
			mg/ml
Infective Endocarditis *Enterococcus*	Benzylpenicillin 300,000 units/kg/24h IV q4-6h **OR** Ampicillin 300 mg/kg/24h IV q4-6h for 4-6weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 4-6 weeks	Penicillin allergic: Vancomycin 40 mg/kg/day IV q8-12h **PLUS** Gentamicin 1mg/kg IV/IM q8h for 2 weeks for 4-6 weeks	
Infective Endocarditis *Staphylococcus* a) Methicillin sensitive b) Methicillin Resistant	Cloxacillin 200 mg/kg/24h IV q4-6h for 6 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for3-5 days Vancomycin 60 mg/kg/24h IV q6h for 6 weeks	**Penicillin allergic:** Cefazolin 100 mg/kg/24h IV q8h for 6 weeks **OR** Vancomycin 40 mg/kg/24h IV q2-4h for 6 weeks	Clinical benefit of Aminoglycosides has not been established. 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. Target trough concentration between 15-20 µg/ml
Culture-Negative Endocarditis	Ampicillin/Sulbactam 300		Patients with culture-negative

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	mg/kg/24h IV q4-6h for 4-6 weeks **PLUS** Gentamicin 1mg/kg IV/IM q8h for 4-6 weeks		endocarditis should be treated in consultation with an ID specialist

CENTRAL NERVOUS INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Meningitis empirical treatment *Haemophilus influenza* *Strepcoccus pneumoniae*	Cefotaxime 50mg/kg IV q4-6h **OR** Ceftriaxone 50-75mg/kg IV q12-24h for 10-14 days. If < 3 month-old, **ADD**: Benzylpenicillin 50mg/kg IVq4-6h **OR** Ampicillin 50mg/kg IV q4-6h Cefotaxime 50mg/kg IV q4-6h **OR** Ceftriaxone 50-75mg/kg IV q12-24h for 10-14 days.	If suspected penicillin-resistant *Strep pneumonia*: Cefotaxime 50mg/kg IV q4-6h **OR** Ceftriaxone for 50-75mg/kg IV q12-24h for 10-14 days **PLUS** Vancomycin 15mg/kg IV q6h Chloramphenicol 40mg/kg IV stat then 25mg/kg q6h for 10-14 days; **OR** Cefepime 50mg/kg IV q8h for 10-14 days.	Prophylaxis for all household contacts if there are unimmunised or partially immunised children < 4 years old.
Neisseria meningitidis	Benzylpenicillin 50mg/kg IV q4-6h for 7 days	Cefotaxime 50mg/kg IV q4-6h **OR** Ceftriaxone 50-75mg/kg IV q12-24h 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
Cryptococcal meningitis *Cryptococcus neoformans*	**Induction Therapy**: Amphotericin B 1.0mg/kg/24h IV		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	PLUS/ MINUS 5-Flucytosine 400-1200mg/m^2 (max 2gm) PO in q6h for 2-4 weeks. **Consolidation Therapy**: Fluconazole 10-12mg/kg/24h PO in q12h for 8 weeks.		
Herpes Simplex Encephalitis	Acyclovir: < 12 weeks old: 20mg/kg IV q8h 12 weeks-12 years old: 500mg/m^2 IV q8h If > 12 years olds: 10mg/kg IV q8h		Duration: for 14-21 days.
Brain Abscess	Cefotaxime 50mg/kg IV q4-6h **OR** Ceftriaxone 50-75mg/kg IV q12-24h **PLUS** Metronidazole 15mg/kg IV stat then 7.5mg/kg IV q8h.	If secondary to trauma: **ADD** Cloxacillin 25-50mg/kg IV q4-6h.	Surgical drainage may be indicated if appropriate. Duration 6-8 weeks, depending on response as seen from neuroimaging.

References :

1. Academy of Medicine of Malaysia Clinical Practice Guidelines on Rational Antibiotic Utilisation in Selected Paediatric Conditions April 2004
2. Tunkel A. R, Hartman B. J, Kaplan S. L, Kaufman B. A, Roos K. L, Scheld W. M, Whitley R.J. Practice Guidelines for the Management of Bacterial Meningitis Clinical Infectious Diseases 2004; Vol 39:1267-1284
3. Therapy of suspected bacterial meningitis in Canadian children six weeks of age and older Infectious Diseases and Immunization Committee, Canadian Paediatric Society (CPS) Paediatrics & Child Health 2008; 13 (4): 309.
4. NICE Clinical Guideline (2010). Bacterial meningitis and meningococcal septicaemia
5. Royal Children Hospital Melbourne (2012). Meningitis/encephalitis guideline
6. The Sanford Guide to Antimicrobial therapy 2011-2012
7. Felsenstein S,Bhanu W, Shingadia D, et al. Clinical and Microbiologic Features Guiding Treatment Recommendations for Brain Abscesses in Children.Pediatr Infect Dis J 2013;32:129-135.
8. Drug Doses Frank Shann 15th edition
9. Clin Inf Dis 2010; 50: 291-322

OTORHINOLARYNGOLOGY INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Tonsillitis/Pharyngitis Group A *streptococcal*	Phenoxymethylpenicillin <27kg: 250mg PO q8-12h for 10 days; ≥27kg: 500mg PO q8-12h for 10 days **OR** Amoxicillin 25 mg/kg PO q12h (max 500mg) for 10 days	**Penicillin Allergy:** Azithromycin 12 mg/kg PO q24h for 5 days **OR** Clarithromycin 7.5mg/kg/dose q12h for 10 days	
Rhinosinusitis *Streptococcus pneumonia* *Haemophilus influenza* *Moraxella catarrhalis*	Amoxicillin/Clavulanate 22.5mg/kg PO q12h for 10-14 days **Severe infection:** Ampicillin/Sulbactam 200–400 mg/kg/day IV q6h **OR** Ceftriaxone 50 mg/kg/day IV q12h **OR** Cefotaxime 100–200mg/kg/day IV q6h	**Risk for antibiotic resistance or failed initial therapy:** Amoxicillin/Clavulanate 45mg/kg PO q12h	Antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course, of high grade fever, purulent nasal discharge.
Acute Otitis Media *Streptococcus pneumonia* *Haemophilus influenza* *Moraxella catarrhalis*	Amoxycillin 40-45 mg/kg PO q12h for 5 days	Amoxicillin/Clavulanate 45 mg/kg PO q12h **OR** Cefuroxime 15 mg/kg PO q12h **OR**	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		Ceftriaxone 50 mg/kg IM/IV for 1 dose **Penicillin Allergy:** Clarithromycin 7.5mg /kg PO q12h **OR** Azithromycin 10mg/kg PO on day 1, followed by 5mg/kg PO q24h on day 2 to day 5	
Acute Diffuse Otitis Externa *P. aeruginosa and Staph. aureus*	Ofloxacin 0.3% otic solution Instill 5 drops into affected ear(s) once daily for 7 days		Aural toileting required in discharging ears 1-12 years. > 12 years refer to adult dose

References: (ADULT & PEADS)

1. Wald ER, Applegate KE, Bordley C, et al. Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. Pediatrics 2013; 132:e262.
2. Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clin Infect Dis 2012; 54:e72.
3. Bradley JS, Jackson MA, Committee on Infectious Diseases, American Academy of Pediatrics. The use of systemic and topical fluoroquinolones. Pediatrics 2011; 128:e1034.
4. Lieberthal AS, Carroll AE, Chonmaitree T, et al. The diagnosis and management of acute otitis media. Pediatrics 2013; 131:e964.
5. Rovers MM, Glasziou P, Appelman CL, et al. Antibiotics for acute otitis media: a meta-analysis with individual patient data. Lancet 2006; 368:1429.
6. Thanaviratananich S, Laopaiboon M, Vatanasapt P. Once or twice daily versus three times daily amoxicillin with or without clavulanate for the treatment of acute otitis media. Cochrane Database Syst Rev 2013; 12:CD004975.
7. Dagan R. The use of pharmacokinetic/pharmacodynamic principles to predict clinical outcome in paediatric acute otitis media. Int J Antimicrob Agents 2007; 30 Suppl 2:S127.
8. Gerber MA, Baltimore RS, Eaton CB, et al. Prevention of rheumatic fever and diagnosis and treatment of acute Streptococcal pharyngitis: a scientific statement from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease in the Young, the Interdisciplinary Council on Functional Genomics and Translational Biology, and the Interdisciplinary Council on Quality of Care and Outcomes Research: endorsed by the American Academy of Pediatrics. Circulation 2009; 119:1541.
9. Wessels MR. Clinical practice. Streptococcal pharyngitis. N Engl J Med 2011; 364:648.
10. Lieberthal AS, Carroll AE, Chonmaitree T, et al. The diagnosis and management of acute otitis media. Pediatrics 2013; 131:e964.
11. Tanz RR, Poncher JR, Corydon KE, et al. Clindamycin treatment of chronic pharyngeal carriage of group A streptococci. J Pediatr 1991; 119:123.
12. Kaplan EL, Gooch III WM, Notario GF, Craft JC. Macrolide therapy of group A streptococcal pharyngitis: 10 days of macrolide therapy (clarithromycin) is more effective in streptococcal eradication than 5 days (azithromycin). Clin Infect Dis 2001; 32:1798.
13. Altamimi S, Khalil A, Khalaiwi KA, et al. Short-term late-generation antibiotics versus longer term penicillin for acute streptococcal pharyngitis in children. Cochrane Database Syst Rev 2012; 8:CD004872.
14. Shulman ST, Bisno AL, Clegg HW, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. Clin Infect Dis 2012; 55:1279.
15. van Driel ML, De Sutter AI, Keber N, et al. Different antibiotic treatments for group A streptococcal pharyngitis. Cochrane Database Syst Rev 2013; 4:CD004406.
16. Ward MA. Emergency department management of acute respiratory infections. Semin Respir Infect 2002; 17:65.
17. Shah RK, Roberson DW, Jones DT. Epiglottitis in the Hemophilus influenzae type B vaccine era: changing trends. Laryngoscope 2004; 114:557.
18. Levenson MJ, Parisier SC, Dolitsky J, Bindra G. Ciprofloxacin: drug of choice in the treatment of malignant external otitis (MEO). Laryngoscope 1991; 101:821.
19. Wald ER, Mason EO Jr, Bradley JS, et al. Acute otitis media caused by Streptococcus pneumoniae in children's hospitals between 1994 and 1997. Pediatr Infect Dis J 2001; 20:34.
20. Kellner JD, Ford-Jones EL. Streptococcus pneumoniae carriage in children attending 59 Canadian child care centers. Toronto Child Care Centre Study Group. Arch Pediatr Adolesc Med 1999; 153:495.
21. Chung A, Perera R, Brueggemann AB, et al. Effect of antibiotic prescribing on antibiotic resistance in individual children in primary care: prospective cohort study. BMJ 2007; 335:429.

22. Wroe PC, Lee GM, Finkelstein JA, et al. Pneumococcal carriage and antibiotic resistance in young children before 13-valent conjugate vaccine. Pediatr Infect Dis J 2012; 31:249.

CHEMOPROPHYLAXIS

NON-SURGICAL

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Rheumatic fever (Secondary prevention)	Benzathine Penicillin IM 1.2 MU (>25kg) ; 0.6 MU (<25 kg) every 3-4 weeks Duration With carditis: 10 yo or until 25 yo Without carditis: 5 yo or until 18 yo	Penicillin V 250mg PO q12h **Penicillin Allergy** : Erythromycin Stearate 250mg PO q12h	
Infective Endocarditis (IE)	Amoxycillin 50mg/kg PO 1 hour before procedure **OR** Ampicillin IV 50mg/kg Include coverage for *staphyloccus* for surgical procedures on infected skin, skin structure, or musculoskeletal tissue **Genitourinary or gastrointestinal procedures:** IE prophylaxis only if ongoing GI or GU tract infection. Require activity against enterococci (amoxicillin or ampicillin) or vancomycin for penicillin allergic	**Penicillin Allergy** : Clindamycin 20mg/kg IV/PO 1 hour before procedure	IE prophylaxis recommended for patients with the highest risk cardiac conditions undergoing procedures likely to result in bacteremia with a microorganism that has the potential ability to cause bacterial endocarditis For Highest risk conditions For highest risk procedures: • Dental procedures that involve manipulation of either gingival tissue or the periapical region of teeth or perforation of the oral mucosa; this does not include routine dental cleaning. • Procedures of the respiratory tract that involve incision or biopsy of the respiratory mucosa

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
			• Procedures in patients with ongoing gastrointestinal (GI) or genitourinary (GU) tract infection • Procedures on infected skin, skin structure, or musculoskeletal tissue • Surgery to place prosthetic heart valves or prosthetic intravascular or intracardiac materials Maintenance of optimal oral hygiene may reduce the incidence of bacteremia from daily activities and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of IE.
Postsplenectomy At risk for *Pneumococcus, Meningococcus, Haemophilus*	Penicillin V PO 125mg q12h for ≤3 yo 250mg q12h for >3yo Duration • Children up to the age of 16 years • Post splenectomy for at least 2-3 years • Indefinitely for patients with an underlying immunodeficiency or immunocompromised state and asplenia. (Require ongoing surveillance for resistant *pneumococci*)	Amoxicillin (20mg/kg/day) **Penicillin Allergy** : Erythromycin Ethylsuccinate 200mg PO daily < 2 yo 400mg daily > 2 yo	Risk of sepsis is lifelong, but especially the first 2 years after splenectomy Important adjunct: Immunization against *pneumococcus, Haemophilus, meningococcus* at least 14 days prior to splenectomy. (If not possible then 14 days postoperative day) Yearly influenza vaccine also recommended. (Please refer relevant immunization guidelines for schedule) To seek immediate medical attention when febrile or to instruct on immediate self-directed empiric antibiotics (Amoxicillin/Clavulanate or Cefuroxime Axetil) before promptly seeking medical care.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Haemophilus influenza b Close contacts	Rifampicin PO Children: 20mg/kg/day q24h for 4 days Infants: 10mg/kg/day q24h for 4 days		Close (household) contact is defined as a person who resides with the index patient or who spent ≥4 hours with the index patient for at least five of the seven days before the day of hospital admission of the index case Indications Household contacts • Household with at least one contact <4 years who has not received an age-appropriate number of doses of Hib conjugate vaccine • Household with a contact who is an immunocompromised child (<18 years), regardless of that child's Hib immunization status Nursery Contact For child-care and preschool contacts (regardless of age or vaccine status) when unimmunized or incompletely immunized children attend the facility and two or more cases of Hib invasive disease have occurred among attendees within 60 days Give chemoprophylaxis to index case if treated with regimens other than cefotaxime or ceftriaxone For Contacts < 2 years not immunized: complete immunization
Meningococcal exposure	Rifampicin PO Children:	Ceftriaxone IM <15 yo : 125mg stat	CLOSE contact defined as individuals who have had prolonged (>8 hours) contact

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	<1 month: 5mg/kg/dose q12h for 2 days >1 month: 10mg/kg/dose (max 600mg) q12h for 2 days	>15 yo : 250mg stat Ciprofloxacin PO >18 yo: 500mg single dose	while in close proximity (<3 ft) to the patient or who have been directly exposed to the patient's oral secretions during the seven days before the onset of the patient's symptoms and until 24 hours after initiation of appropriate antibiotic therapy: All household, child care and nursery, school contacts <u>Others</u> • 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 <u>Healthcare staff</u> Routine prophylaxis not recommended, unless exposure to secretions such as unprotected mouth to mouth resuscitation, intubation or suctioning
Neonatal Group B *Strep* Infection Treat during labour if previously delivered infant with invasive GBS, GBS bacteriuria or antenatal screening swabs positive OR if GBS status not known AND any of the following: • Preterm <37 weeks	Intrapartum maternal prophylaxis till delivery Penicillin G IV (5MU load then 2.5MU q6h till delivery)	Ampicillin 2gm IV load then 1gm q6h <u>Penicillin allergy</u> Clindamycin 900mg IV q8h (according to susceptibility) **OR** Vancomycin (weight based dosing 20mg/kg, max 2gm q12h)	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
• PROM >18 hours • Intrapartum temp >38ºC			
Malaria prophylaxis	Please refer to National Guidelines on Malaria		
Pertussis (Postexposure prophylaxis)	<1 month : Azithromycin 10mg/kg q24h for 5 days >1 month : Erythromycin Ethylsuccinate 40-50mg/kg/day q6h for 14 days		Antimicrobial prophylaxis for close contacts of the index case and for exposed individuals at high risk for severe or complicated pertussis <u>Close contact definition</u>: • Face-to-face exposure within three feet of a symptomatic patient • Direct contact with respiratory, oral, or nasal secretions from a symptomatic patient • Sharing the same confined space in close proximity with a symptomatic patient for ≥1 hour <u>At risk:</u> • Infants younger than one year, especially <4 months of age • Persons with immunodeficiency • Persons with underlying medical conditions (chronic lung disease, respiratory insufficiency, cystic fibrosis) • Because of the risk of severe disease in infants younger than one year of age, especially those younger than four months of age, women in the third trimester of pregnancy should be given postexposure prophylaxis

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
			complete immunization for close contact ≤ 7 years of age Routine vaccination of children, adolescents, and adults (including pregnant women) is the most important preventive strategy
Chicken pox (Postexposure prophylaxis) Active Passive	Varicella vaccine: Within 3-5 days of exposure for the susceptible healthy adult/child For patients who are at high risk for severe infection and complications, and who are not candidates for the VZV vaccine Varicella zoster immune globulin (dose as per product information – weight based) **OR** IVIG (400mg/kg) As soon as possible after exposure up to10 days after Patients receiving monthly high dose (≥400mg/kg) IVIG are likely to be protected and probably do not require VariZIG if the most recent dose of IVIG was		For passive PEP: Susceptible hosts include Immunocompromised children and adults who lack evidence of immunity to VZV Newborns of mothers with varicella shortly before or after delivery (ie, 5 days before to 2 days after delivery) Premature infants born at ≥28 weeks of gestation who are exposed during their hospitalization and whose mothers do not have evidence of immunity Premature infants born at <28 weeks of gestation or who weigh ≤1000 g at birth and were exposed during their hospitalization, regardless of their mothers' evidence of immunity to varicella

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	administered ≤3 weeks before exposure		

References:
1. Dajani A, Taubert K, Ferrieri P, Peter G, Shulman S. Treatment of acute streptococcal pharyngitis and prevention of rheumatic fever: a statement for health professionals. Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease of the Council on Cardiovascular Disease in the Young, the American Heart Association. Pediatrics. 1995;96:758-64
2. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association. Circulation. 2007;116:1736.
3. Davies JM, Lewis MP, Wimperis J et al. Review of guidelines for the prevention and treatment of infection in patients with an absent or dysfunctional spleen: prepared on behalf of the British Committee for Standards in Haematology by a working party of the Haemato-Oncology task force. Br J Haematol. 2011;155:308-17
4. Keenan RD, Boswell T, Milligan DW. Do post-splenectomy patients take prophylactic penicillin?. Br J Haematol. 1999;105:509
5. American Academy of Pediatrics. Haemophilus influenzae infections. In: Red Book: 2012 Report of the Committee on Infectious Diseases, 29th, Pickering LK. (Ed), American Academy of Pediatrics, Elk Grove Village, IL 2012. p.345
6. Gardner P. Clinical practice. Prevention of meningococcal disease. N Engl J Med. 2006;355:1466
7. Verani JR, McGee L, Schrag SJ, Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC). Prevention of perinatal group B streptococcal disease--revised guidelines from CDC, 2010. MMWR Recomm Rep 2010; 59:1
8. American Academy of Pediatrics. Pertussis (whooping cough). In: Red Book: 2012 Report of the Committee on Infectious Diseases, 29th, Pickering LK. (Ed), American Academy of Pediatrics, Elk Grove Village, IL 2012. p.553
9. Updated recommendations for use of VariZIG--United States, 2013. Centers for Disease Control and Prevention (CDC). MMWR Morb Mortal Wkly Rep. 2013;62(28):574

GASTROINTESTINAL INFECTIONS

Infection/Condition & 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
Dysentery *Shigella, E. coli, Campylobacter* Mild or uncomplicated Severe	Most mild infections resolved spontaneously without antibiotics Trimethoprim/Sulphamethoxazole (TMP: 5-8mg/kg/24h) PO in 2 divided doses for 5-7 days Cefotaxime 25-50mg/kg IV q6-8h for 7 days	Ampicillin 100mg/kg/24h PO in 4 divided doses for 5-7 days	
Dysentery *Amoebiasis*	Metronidazole 30-50mg/kg/24h PO in 3 divided doses for 5 days (10 days for severe infection)		
Giardiasis	Metronidazole 30mg/kg/24h PO once daily for 3 days		
Typhoid fever *Salmonella* Typhi *S. paratyphi* Mild or uncomplicated	Ciprofloxacin 15-20mg/kg/d PO in 2 divided doses for 5-7 days	Chloramphenicol 50-100mg/kg/d PO in q6h for minimum 14 days *Ciprofloxacin IV 10-15mg/kg IV q12h for 7-14 days	*Fluoroquinolones 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

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Severe infection or suspected resistant organism Chronic carrier state (> 1 year)	Ceftriaxone 60-80mg/kg IV q24h for 7-14 days Ampicillin/Amoxycillin 100mg/kg/24h PO in q6-8h for 6 weeks **OR** Trimethoprim/Sulphamethoxazole 8 mg (TMP)/kg/24h PO in q12h for 6 weeks	*Ciprofloxacin 20-30mg/kg/24h PO in q12h for 4 weeks	and efficacy of quinolones in children
Cholera	Trimethoprim/ Sulphamethoxazole 8-10mg (TMP)/kg/24h PO in q12h 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) (2mg/kg 12hly -severe)	Erythromycin 50mg/kg/24h PO in q6h 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 or IV rehydration is the cornerstone of treatment. Antibiotics therapy reduces the volume and duration of diarrhoea - Monitor antimicrobial sensitivity pattern at beginning of & during the outbreak as it can change - Avoid using Tetracycline or Doxycycline for young children as they can cause staining of the teeth
Liver abscess (amoebic) *Entamoeba histolytica*	Metronidazole 7.5mg/kg IV q8h for 10-14 days		Amoebic abscess tend to be solitary lesion. Consider surgical drainage if needed
Liver abscess (pyogenic) *S. aureus,* Gram negative, Anaerobes	Cloxacillin 25-50mg/kg IV q4-6h **PLUS** Gentamicin 5mg/kg IV q24h **PLUS**	Cefotaxime 25-50mg/kg IV q6-8h **PLUS** Metronidazole 7.5mg/kg IV q8h	Surgical drainage is needed in most cases

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	Metronidazole 7.5mg/kg IV q8h for 4-6 weeks		
Acute cholangitis Gram negative, anaerobes, gram positive	Ampicillin 25-50mg/kg IV q6h **PLUS** Gentamicin 5mg/kg IV q24h **PLUS** Metronidazole 7.5mg/kg IV q8h for 7-14 days	Cefoperazone 25-50mg/kg IV q6-8h **PLUS** Metronidazole 7.5mg/kg IV q8h	
Peritonitis Gram negative, anaerobes, gram positive	Ampicillin 25-50mg/kg IV q6h **PLUS** Gentamicin 5mg/kg IV q24h **PLUS** Metronidazole 7.5mg/kg IV q8h for 7-14 days	Cefotaxime 25-50mg/kg IV q6-8h **PLUS** Metronidazole 7.5mg/kg IV q8h for 7-14 days	May omit metronidazole in primary peritonitis

References :
1. WHO/FCH/CAH/03.7 (2005). The treatment for diarrhoea: a manual for physicians and senior health workers
2. Cunha BA. Antibiotic Essentials 2012. 11th Edition
3. The Sanford Guide to Antimicrobial Therapy 2011-2012
4. WHO/V&B/03-07 (2003) Background document: the diagnosis, treatment and prevention of typhoid fever
5. Mishra K, Basu S,Roychoudury S, et al. Liver abscess in children: an overview. World J Pediatr 2010;6(3):210-216.
6. Liver Abscess in Children: A 10-year Single Centre Experience Saudi J Gastroenterology 2011; 17(3)199
7. BNF for children 2011-2012
8. Cherry J, Demmler-Harisson GJ, Kaplan SL, et al. Feigin & Cherry's Textbook of Paediatric Infectious Diseases 6th Ed
9. Frank Shann, Sixteenth Edition 2014

INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
First Line Febrile neutropenia Fever >38°C Neutrophil<500mm^3 *Klebsiella* sp (non ESBL), *E.coli, Pseudomonas*	Cefepime 50mg/kg IV q8h	Piperacillin/Tazobactam <9 months : 80 mg/kg IV q8h 9mth-<40kg : 100 mg/kg IVq8h >40 kg : 3gm IV q6h	Meta analysis has shown that there is no clinical advantage with β lactam- aminoglycoside combination therapy[1]
Second Line Persistent fever > 72 hours MRSA , *ESBL Klebsiella,* coagulase -ve *staph*	Imipenem 25mg/kg IV q6h **PLUS/MINUS** Vancomycin 15mg/kg IV q6h	Meropenem 20mg/kg IV q8h **PLUS/MINUS** Vancomycin 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 > 4- 7 days with no identified source of fever[3] *Candida* sp. *Aspergillus* sp.	Imipenem 25mg/kg IV q6h **PLUS** Amphotericin B 0.5mg/kg IV and gradually escalate by 0.25 to 1mg/kg q24h(max. 1.5 mg/kg/d)	Meropenem 20mg/kg IV q8h **PLUS** Amphotericin B 0.5mg/kg IV and gradually escalate by 0.25 to 1mg/kg q24h(max. 1.5 g/kg/d)	1/3 of febrile neutropenia patients with persistent fever >1 week have systemic fungal infections[2]

References :

1. β lactam monotherapy versus β lactam-aminoglycoside combination therapy for fever with neutropenia: systematic review and meta-analysis. BMJ 2003; 326:1111
2. Clinical practice guideline for the use of antimicrobial agents in neutropenic patients with cancer: 2010 update by the Infectious Diseases Society of America. Freifeld AG, Bow EJ, Sepkowitz KA, Boeckh MJ, Ito JI, Mullen CA, Raad II, Rolston KV, Young JA, Wingard JR, Clin Infect Dis. 2011;52(4):e56.
3. Guideline for the management of fever and neutropenia in children with cancer and/or undergoing hematopoietic stem-cell transplantation. Lehrnbecher T, Phillips R, Alexander S, Alvaro F, Carlesse F, Fisher B, Hakim H, Santolaya M, Castagnola E, Davis BL, Dupuis LL, Gibson F, Groll AH, Gaur A, Gupta A, Kebudi R, Petrilli S, Steinbach WJ, Villarroel M, Zaoutis T, Sung L , J Clin Oncol. 2012;30(35):4427.

NEONATAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Congenital & Perinatal Infections			
Congenital Syphilis *T. pallidum*	Aqueous crystalline penicillin G: 50,000 units/kg IV q12h during the first 7 days of life and q8h thereafter) for 10 days <u>If diagnosed with congenital syphilis after one month of age:</u> Aqueous Penicillin G 50,000 units/kg IV q4-6h for 10 days. If findings compatible with CNS involvement, some experts suggest that 10 days course of aqueous penicillin be followed with a single dose of benzathine penicillin 50,000 units/kg im	Procaine Penicillin G, 50,000 units/kg IM daily in a single dose for 10 days.	Only severe cases are clinically apparent at birth. Refer to algorithm for diagnosing and evaluation in: American Academy of Pediatrics. Syphilis. In: Red Book: 2012 Report of the Committee on Infectious Diseases, 29th ed, Pickering LK (Ed) • Isolate till non infectious (at least 24 hours of treatment) • Screen for other STDs and HIV • If more than one day of penicillin therapy is missed, the entire course should be restarted • Investigate and treat parents • Evaluation of the siblings of an index case of congenital syphilis may be warranted if such an evaluation did not occur previously Follow-up: Nontreponemal serologic tests at 3,6,12 and 24 months. (Should become neg by 6 months) For those with abnormal CSF – recommended to repeat CSF FEME and VDRL at 6 month intervals. Persistent +VDRL of CSF requires reevaluation and possible re-treatment
Congenital Toxoplasmosis *T. gondii*	Pyrimethamine (initial loading dose of 2 mg/kg PO once/day for 2 days followed by 1 mg/kg PO once/day, max 25 mg) for 6 months, then 3 times a week for subsequent 6 months **PLUS** Sulfadiazine (50 mg/kg/dose PO q12h, maximum 4 gm) for 1 year	Fansidar Pyrimethamine (1.25 mg/kg every 15 days) **PLUS** Sulfadoxine (25 mg/kg every 15 d) for 24 months **PLUS** Folinic Acid, 5 mg/week by mouth	Drug regimen not definitively established. Clinical trials ongoing. Prednisolone (0.5 mg twice per day) can be added if cerebrospinal fluid (CSF) protein is >1 gm/dL or when active chorioretinitis threatens vision and continued until resolution of elevated CSF protein or active chorioretinitis that threatens vision.

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	PLUS Leucovorin (10 mg PO 3 times a week) for 1year (and for one week after Pyrimethamine therapy) (IV formulation of Leucovorin may be considered for oral use)		Clindamycin may be substituted for sulfadiazine in children with G6PD deficiency or who develop allergy to sulphadiazine Regular FBC recommended: Main adverse effect of pyrimethamine is neutropenia. The folinic acid dose should be increased if the ANC falls below 1000 cells/microL. Pyrimethamine should be temporarily withheld if the ANC is below 500 cells/microL. Persistent neutropenia despite withholding of pyrimethamine may be caused by Sulfadiazine
Herpes Simplex **Neonatal** • Localized skin, eye, and mouth (SEM) • Central nervous system (CNS) with or without SEM • Disseminated disease involving multiple organs	Acyclovir 60mg/kg/day 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 therapy for HSV PCR and treat till negative Investigate and treat parents Recurrence of HSV can occur and may be a lifelong problem
Tetanus neonatorum	Metronidazole IV/PO for 10 days <u>Neonates (Neofax dosing):</u> • Loading dose: 15mg/ kg/dose IV/PO x 1 • Maintenance dose: 7.5mg/ kg/dose IV/PO Metronidazole Dosing Interval Chart	Penicillin G IV (100 000U/kg q12h for 1st week of life and q6h after 1st week) for 10 days	Debridement Human Tetanus IG im Optimum dose for im human TIG yet to be established. Traditional recommendations: single dose of 3000-6000U. Limited data suggests doses as low as 500U as effective. Penicillin - GABA antagonist and associated with seizures. Metronidazole recommended as choice.

<table>
<tr><th>Infection/Condition & Likely Organism</th><th colspan="2">Suggested Treatment</th><th>Comments</th></tr>
<tr><th></th><th>Preferred</th><th>Alternative</th><th></th></tr>
<tr><td></td><td><table>
<tr><th>Post-menstrual age (weeks)</th><th>Post-natal age (days)</th><th>Dosing interval (hours)</th></tr>
<tr><td>≤ 29 weeks</td><td>0-28 days
>28 days</td><td>q48h
q24h</td></tr>
<tr><td>30 to 36 weeks</td><td>0-14 days
>14 days</td><td>q24h
q12h</td></tr>
<tr><td>37 to 44 weeks</td><td>0-7 days
>7 days</td><td>q24h
q12h</td></tr>
<tr><td>≥ 45 weeks</td><td>AL</td><td>q8h</td></tr>
</table></td><td></td><td>Check maternal immunization</td></tr>
<tr><td>Gonococcal Ophthalmitis</td><td>Immediate and frequent saline eye irrigation
Non-disseminated disease
Ceftriaxone 50mg/kg IV once (max 125mg)

Disseminated disease
Ceftriaxone IV (50mg/kg daily 1st week of life, 12H >1week of life) for 7 days
Duration 10-14 days if meningitis documented
(Cefotaxime for neonates with hyperbilirubinemia:</td><td></td><td>Evaluate for signs of disseminated infection (e.g., sepsis, arthritis, and meningitis)

Screen mother and baby for chlamydial infection

Screen for other STDs
Investigate and treat parents</td></tr>
</table>

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
	25 mg/kg IV/IM q12h for 7 days, with a duration of 10–14 days, if meningitis is documented)		
***Chlamydia trachomatis* conjunctivitis**	Erythromycin base or Ethylsuccinate 50mg/kg/day PO q6h for 14 days (Topical therapy not necessary if systemic treatment given)	Azithromycin 20 mg/kg/day PO, 1 dose daily for 3 days	Initial treatment for chlamydial conjunctivitis should be based upon a positive diagnostic test 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 treatment may be required.
Early onset sepsis (<48 hrs) Sepsis / pneumonia / meningitis) GBS, GNB For meningitis Pathogen unknown Gram negative	Penicillin G IV **OR** Ampicillin IV **PLUS** Gentamycin IV (Till C&S results) Sepsis 7-10 days G+ meningitis: 2 weeks G- meningitis : 3 weeks Amoxcillin IV **PLUS** Cefotaxime IV Cefotaxime IV	Ampicillin **PLUS** Cefotaxime	Suspect in maternal chorioamnionitis, sepsis, PROM (>18 hours) Do full septic workup, CXR In babies given antibiotics because of risk factors for infection or clinical indicators of possible infection, review need for continued antibiotics at 36 hours with culture results 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 Tailor according to culture results (Drug Dosages – Refer Frank Shann)

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Gram positive	Amoxicillin IV **PLUS** Cefotaxime IV		
GBS Infection *Streptococcus agalactiae*	Penicillin G IV **OR** Ampicillin IV **PLUS** Gentamycin IV		Duration: Sepsis: 10 days Meningitis: 14 days Osteomyelitis: 4 weeks
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	Penicillin PLUS Cefotaxime	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 (Drug Dosages – Refer Frank Shann)
Hospital Acquired Infection (Pneumonia, sepsis, meningitis) Based on predominant flora and susceptibility Coagulase-negative *staphylococci*, *Staphylococcus aureus, E.*	CloxacillinIV **PLUS** Gentamicin **OR** Netilmicin **OR** Amikacin IV	Cefotaxime IV **PLUS** Gentamicin **OR** Netilmicin **OR**	Possibility of GNB with inducible β-lactamases and ESBL producing *Klebsiella* and *E. coli* where β-lactams are avoided and may require carbepenems

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
coli, Klebsiella, Pseudomonas, Enterobacter, Candida, GBS, *Serratia, Acinetobacter*	(Use cloxacillin if *Staph aureus* is a problem in the respective nursery. Otherwise replace Cloxacillin with any other antibiotic appropriate for the predominant flora)	Vancomycin IV if MRSA strongly suspected	
Necrotising Enterocolitis (NEC) *Klebsiella, E. coli, Clostridia, coagulase* negative *Staphylococcus*, *Enterococci*, *Bacteroides*	Ampicillin IV **PLUS** Gentamycin IV **PLUS** Metronidazole IV Duration 10-14 days (Vancomycin if CoNS MRSA or VRE suspected)	Amoxicillin/Clavulanate **PLUS** Gentamicin **OR** Netilmicin	There is insufficient evidence regarding choice of antibiotic regimens or duration of antibiotic treatment of NEC. Decisions regarding antibiotic choice and duration might best be guided by culture results as wellas flora & antibiotic resistance patterns present within nurseries Empiric regimens can be modified based upon the results of cultures of blood, peritoneal fluid, or surgical specimens

References

1. American Academy of Pediatrics. 2012 Red Book: Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: American Academy of Pediatrics.
2. Workowski KA, Berman S Sexually transmitted diseases treatment guidelines, 2010. , Centers for Disease Control and Prevention (CDC) MMWR Recomm Rep. 2010;59(RR-12):1.
3. Remington JS, McLeod R, Thulliez P, Desmonts G. Toxoplasmosis. In: Remington JS, Klein JO, eds. Infectious diseases of the fetus and newborn infant. 5th ed. Philadelphia: Saunders, 2001:205-346.
4. McAuley J, Boyer KM, Patel D, Mets M, Swisher C, Roizen N, et al. Early and longitudinal evaluations of treated infants and children and untreated historical patients with congenital toxoplasmosis: the Chicago Collaborative Treatment Trial. Clin Infect Dis 1994;18:38-72.
5. McLeod R, Boyer K, Karrison T, Kasza K, et al, and Toxoplasmosis Study Group *Clinical Infectious Diseases*, volume 42 2006;1383-94
6. Villena, D. Aubert, B. Leroux, D. Dupouy, M. Talmud, C. Chemla, T. Trenque, G. Schmit, C. Quereux, M. Guenounou, M. Pluot, A. Bonhomme, J. M. Pinon Pyrimethamine-sulfadoxine Treatment of Congenital Toxoplasmosis: Follow-up of 78 Cases Between 1980 and 1997 Scandinavian Journal of Infectious Diseases 1998;30:295-300
7. American Academy of Pediatrics. 2003 Red Book: Report of the Committee on Infectious Diseases. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2003:344-353
8. Kimberlin, D.W., Neonatal Herpes simplex infectio . Clinical Microbiology reviews. 2004;17:1-13
9. American Academy of Pediatrics. 2003 Red Book: Report of the Committee on Infectious Diseases. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2003:611-616
10. Farrar JJ et al. Tetanus. J Neurol Neurosurg Psychiatry. 2000;69:292-301
11. American Academy of Pediatrics. 2003 Red Book: Report of the Committee on Infectious Diseases. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2003:285-291
12. Centers for Disease Control and Prevention. Gonococcal infections. Sexually transmitted diseases treatment guidelines. MMWR Recomm Rep 2006 August 4, 2006 / 55(RR11);42-49.
13. Mtitimila EI, Cooke RWI. Antibiotic Regimens for suspected early-onset sepsis. Cochrane Database of Systematic Reviews. 2006. Issue 4.
14. Antibiotics for early-onset neonatal infection. NICE clinical guideline 149. Aug 2012
15. Gordon A, Jeffrey HE. Antibiotic Regimens for suspected late-onset sepsis in newborn. Cochrane Database of Systematic Reviews. 2006. Issue 4
16. Shah D, Sinn JK. Antibiotic regimens for the empirical treatment of newborn infants with necrotising enterocolitis Cochrane Database Syst Rev. 2012;8:CD007448.
17. Centers for Disease Control and Prevention. Chlamydial infections. Sexually transmitted diseases treatment guidelines. MMWR Recomm Rep 2006 August 4, 2006 / 55(RR11);38-42

18. Hammerschlag MR, Gelling M, Roblin PM, Kutlin A, Jule JE. Treatment of neonatal chlamydial conjunctivitis with azithromycin. Pediatr Infect Dis J. 1998; 17:1049-50.
19. Centers for Disease Control and Prevention. STD Surveillance case definitions. http://www.cdc.gov/std/stats/CaseDefinitions-2014.pdf

OCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Preseptal cellulitis *Strep pneumoniae, Staphaureus, Strepcoccu* ssp. Systemically unwell	Amoxicillin/Cavulanate 22.5mg/kg PO q12h for 5-7 days Cloxacillin 25-50mg/kg (max 2gm) IV q6h **PLUS** Cefotaxime 50mg/kg (max 2gm) IV q8h **OR** Ceftriaxone 50mg/kg IV (max 2gm) q12h	Cloxacillin 12.5-25mg/kg (max 1gm) PO q6h **OR** Cephalexin 25mg/kg (max 1gm) PO q8h	Failure to respond within 24-48 hours may indicate orbital cellulitis or underlying sinus disease
Orbital Cellulitis/ Abscess *Strep pyogens, Strep pneumonia, Staph aurea* *H. influenza* (unvaccinated child or untypeable strains)	Ceftriaxone 50mg/kg(max 2gm) IV q12h **PLUS** Cloxacillin 50mg/kg (max 2gm) IV q6h for 7-14 days	**Penicillin Allergic** : may consider Clindamycin **PLUS** Ciprofloxacin **OR** Vancomycin	This condition is considered surgical emergency and require immediate consultation with ENT surgeon and ophthalmologist. Urgent CT scan neede to exclude associated abscess and intracranial extension. Urgent surgical drainage of the ethmoid sinuses or of an orbital, subperiosteal or intracranial abscess may be needed.

References:
1. Clinical Practice Guideline: Periorbital and orbital cellulitis; The Royal Children's Hospiral, Melbourne. Last updated 25 August 2013.
2. *Therapeutic Guideline: Antibiotics 14th edition*. Therapeutic Guideline Ltd: Melbourne 2010.
3. Ellen R. W. Chapter 87: Periorbital and Orbital Infection in Principles and Practice of Pediatric Infectious Diseases edited by Sarah S. Long, 4th Edition, 2012.
4. Botting AM, McIntosh D, Mahadevan M; Paediatric pre- and post-septal peri-orbital infections are different diseases. A retrospective review of 262 cases.
5. Int J Pediatr Otorhinolaryngol. 2008 Mar;72(3):377-83. doi: 10.1016/j.ijporl.2007.11.013. Epub 2008 Jan 11.

RESPIRATORY INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
LOWER RESPIRATORY TRACT INFECTION			
Community Acquired Pneumonia			
Pneumonia outpatient	Amoxycillin 45-75mg/kg/24h PO q8h for 5-7 days	Amoxycillin/Clavulanate Cefaclor Erythromycin Azithromycin Clarithromycin	Macrolide antibiotics should be used if either mycoplasma or chlamydia pneumonia is suspected. It may be added at any age if there is no response to first-line empirical therapy.
Pneumonia inpatient	Benzylpenicillin 30-60mg/kg IV q6h for 7 days		Macrolide antibiotics should be used if either *mycoplasma* or *chlamydia pneumonia* is suspected
Severe Community Acquired Pneumonia			
Severe community acquired	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 **OR** Azithromycin 15mg/kg IV loading dose then 7.5 mg/kg q24h if considering atypical organisms		Add IV Cloxacillin if considering *Staphylococcus aureus*

References:
1. Empiric Antibiotic Guidelines- Sydney Childrens Hospital 2012
2. Respiratory tract infections – antibiotic prescribing: Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care. NICE clinical guidelines Issued: July 2008

3. Guidelines for the management of community acquired pneumonia in children: update 2011 British Thoracic Society Community Acquired Pneumonia in Children Guideline Group Thorax 2011;66:ii
4. The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America Clinical Infectious Diseases 2011;53(7):e25–e76
5. Paediatric Protocols For Malaysian Hospitals 3st Edition 2012 Ministry Of Health Malaysia
6. Drug Doses Frank Shann 15th edition
7. The Diagnosis and Management of Acute Otitis Media Pediatrics 2013;131:e964–e999

SKIN & SOFT TISSUE INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Abscess *Staphyloccus aureus*	Cloxacillin 100-200mg/ kg/24h PO/IV q6h for 7-10 days		Incision & drainage if indicated. Pus for culture. Parenteral route for severe infections. Consider CA-MRSA if poorly resolving , based on local epidemiology.
Animal bites *Pasteurella multocida, Staphy.* spp, *Streptococcus* spp , *Capnocytophaga,* anerobes	Ampicillin/Sulbactam 50 mg/kg (ampicillin component) IV q6h for 7 days	Piperacillin/Tazobactam 125 mg/kg IV (piperacillin component) q8h	Consider rabies prophylaxis according to local epidemiology
Cellulitis *Staphyloccus aureus Streptococcus pyogenes*	Cloxacillin 100-200mg/ kg/24h PO/IV q6h for 7-10 days	Amoxicillin 25-30mg/kg/24h PO q8h for 7 days **OR** Cephalexin 50-75mg/kg/24h PO q6-8h for 7 days	Parenteral route for extensive lesions
Hansen's Disease (Leprosy) in children	**Paucibacillary** **10-14 years** Rifampicin 450mg PO monthly **PLUS** Dapsone 50mg PO q24h **<10 years** **PLUS** Rifampicin 10mg/kg PO monthly **PLUS** Dapsone 2mg/kg PO q24h Duration: 6 months Surveillance: 5 years **Multibacillary**		

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	10-14 years Rifampicin 450mg PO monthly **PLUS** Dapsone 50mg PO q24h **PLUS** Clofazimine 150mg PO monthly and 50mg EOD **<10 years** Rifampicin 10mg/kg PO monthly **PLUS** Dapsone 2mg/kg PO q24h **PLUS** Clofazimine 6mg/kg PO monthly and 1mg/kg EOD Duration: 1 year for BI < 4 and 2 years for BI ≥ 4 Surveillance: **15 years**		
Impetigo *Staphylococcus aureus, Streptococcus pyogenes* Localised Generalised	Topical 2% fusidic acid q8-12h for 7 days (outpatient) Cloxacillin 50-100 mg/kg/24h PO q6h for 7 days	Amoxycillin /Clavulanate 25-30mg/kg/24h PO q12h for 7 days **OR** Cephalexin 50-75 mg/kg/24h PO q6-8h for 7 days	
Necrotizing fasciitis	Benzylpenicillin 50,000 units/kg IV		Aggressive surgical debridement;

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Group A Streptococcus Polymicrobial: Gram +ve cocci, Anerobes , Gram-ve rods	q4h **PLUS** Clindamycin 25-40 mg/kg/d IV q6-8h **OR** Piperacillin/Tazobactam 60-75 mg/kg/dose IV q6h **PLUS** Vancomycin 10-13 mg/kg/dose IV q8h		consider adding IVIG to bind toxin for streptococcal infection with toxic shock. Tissues should be gram stained and cultured. Refer IDSA 2014 guidelines
Scalded skin syndrome *Staphylococcus aureus*	Cloxacillin 150 mg/kg/24h IV in q6h then, step down to 50mg/kg/24h PO q6h for 7 days **OR** Cephalexin 50-75mg/kg/24h PO q8h for 7 days		
Scabies *Sarcoptes scabeii*	Permethrin 5% cream apply and leave for 8 hours (not for babies less than 2 months) - two or more applications , each a week apart **Babies less than 2 month :** Sulphur 6% in calamine lotion q12h **OR** Crotamiton (Eurax) cream q12h for 2-3 weeks	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)	

References:

1. Drug doses Frank Shann 15th edition
2. Antibiotic guideline Royal Children's Hospital http://www.rch.org.au/clinicalguide/
3. John Hopkins Antibiotic guideline 2013-2014
4. Empiric Antibiotic Guidelines 2012 - Sydney Children Hospital http://www.cdc.gov/parasites/scabies/health_professionals/meds.html Practice
5. Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America Stevens DL ,Bisno AL, Chambers HF et al. DOI: 10.1093/cid/ciu296
6. Refer IDSA 2014 guidelines
7. *Malaysian Clinical practice Guideline on Management of Leprosy 2014*

SURGICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
REFER TO ADULT GUIDELINE WITH DOSE ADJUSTMENT FOR CHILDREN			
A. General Surgery			
Empyema thoracis (Lung empyema): *Staph aureus* *Streptococcus pneumonia* Empiric treatment: Need to cover organisms mentioned above. Other bacteria implicated: Strep pyogenes, Haemophilus influenza, other gram negative organisms in immunocompromised individuals In patients not responding to treatment need to rule out TB	Cefuroxime 50mg/kg/dose IV q8h **PLUS** Cloxacillin 50mg/kg/dose IV q6h	***Staph aureus* (methicillin sensitive):** Cloxacillin 50mg/kg/dose IV q6h ***Streptococcus pneumonia* (penicillin sensitive):** Benzylpenicillin 200-400,000 MU/kg/day IV q4-6h ***Streptococcus pneumonia* (penicillin resistant-use result of C&S):** Cefuroxime 50mg/kg/dose q8h **OR** Amoxycillin/Clavulanate: 30mg/kg/dose q8h (up to 50mg/kg of ampicilin)	Based on C&S of pleural fluid/tissue or blood culture All children with empyema need to receive high dose antibiotic therapy via intravenous route to ensure pleural penetration Pneumatocoele on CXR indicate *Staph aureus* BUT they can also been seen in pneumococcal disease. There is NO need to routinely use a macrolide antibiotic but its use should be considered in children whom *Mycoplasma pneumonia is* thought to be the cause (*Mycoplasma* usually cause effusion ,not empyema) There is NO CONSENSUS on how long antibiotic need to be given. Most recommend 4-6 weeks of total antibiotics. For other adjunct therapy-refer consensus guideline 2013-MOH
Enterocolitis *Enterobacteriaceae , Enterococci, Bacteroides*	Ampicillin 50mg/kg/dose IV q8h **PLUS**	Amoxycillin/Clavulanate: 30mg/kg/dose IV q8h (up to 50mg/kg of ampicilin)	Antibiotics should be adjusted with results of C&S

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	Metronidazole 15mg/kg loading followed by 7.5mg/kg/dose IV q8h	**OR** Cefotaxime 50mg/kg/dose q8h **PLUS** Metronidazole 15mg/kg loading followed by 7.5mg/kg/dose IV q8h	
B. Bone & Joints Infections			
Septic Arthritis(SA) & Osteomyelitis (OM): 0-2 months: *Staph. aureus.* *Streptococcus agalactiae* Gram negative enteric organism	**0-2 months:** Cloxacillin 50mg/kg dose IV q6h **PLUS** Cefotaxime 50mg/kg/dose q6-8h	Amoxycillin/Clavulanate 30-50mg/kg/dose IV q8h (based on amoxycilin dose) Optimize antimicrobial treatment based on C&S	Empiric antibiotics should be started based on clinical diagnosis of SA or OM Surgical debridement often not required in OM Urgent wash out& drainage is needed in SA in hip and other joints to reduce pressure on growth plate *IV antibiotics can be switch to oral if no concurrent bacterimia when: Child a febrile and pain free for at least 24 hrs and CRP <20mg/L or CRP decreased by≥2/3 of highest value **Duration of antibiotics:** SA: total of 3-4 weeks OM: 4-6 weeks In complex disease (multifocal, significant bone destruction, immuno -compromised host and resistant /unusual pathogens-need prolonged intravenous antibiotics and duration might exceed 6 weeks
Less than 5 yrs: *Staph. aureus.* *Streptococcus pyogens* *Streptococcus pneumoniae* Non- type able *Haemophilus* spp. *K.Kingae*	**Children less than 5 yrs:** Cefuroxime 50mg/kg/dose IV q8h (monotherapy)	Cefazolin 25mg/kg/dose IV q8h Can be use in children with suspected *Staph aureus* or *Strep pyogenes*; Less hypersensitivity reaction compared to Cloxacillin and dosing convenience	
Older than 5 yrs: *Staph. aureus.* *Streptococcus pyogens*	**Children older than 5yrs:** Cloxacillin 50mg/kg/dose IV q6h	**Kingenella kingae*-uncommon organism causing infection in <5yrs old ;sensitive to β-*lactam* antibiotics e.g. Cefuroxime or Ampicilin/Clavulanate	

References:
1. American Academy of Pediatrics: Pickering LK, BakerCJ, Kimberlin DW, Long SS, eds.Red Book 2012 Report of the committee on Infectious Diseases.

2. Paediatric Empyema Thoracis recommendations for management-Position Statement from the Thoracic society of Australia and New Zealand 2010.
3. Manual of childhood infections-Blue Book 3rd edition; Oxford University Press.
4. Guideline for the management of community acquired pneumonia in children; update 2011.Thorax October 2011: vol 66 (supplement 2)
5. Kathleen Gutierrez. Bone and Joint infections in children. Pediatr Clin N Am 52(2005); 779-794.
6. Approach and management of empyema thoracis in children: a consensus guideline from the paediatric empyema working group 2013-MOH.

TROPICAL INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
1. Typhoid fever	Refer to Gastrointestinal infections Section		
2. Cholera	Refer to Gastrointestinal infections Section		
3. Scrub Thyphus			
Ricketsia tsutsugamushi	For children > 8 yr: Doxycycline 2-4mg/kg/24h q12-24h for 5-7 days **OR** Azithromycin 10mg /kg PO q24h for 3 days	Chloramphenicol 50-75mg/kg/24h PO q6h for 5-7 days	Avoid using Tetracycline or Doxycycline for young children as they can cause staining of the teeth
4. Brucellosis			
B. melitensis, *B. abortus, B. suis and B. canis*	For children < 8 yr: Trimethoprim/ Sulfamethoxazole 8/40mg/kg/24h PO q12h for 6 weeks **PLUS** Streptomycin 30 mg/kg (max 1gm) IM q24h for 3 weeks	Trimethoprim/ sulfamethoxazole 8/40mg/kg/24h PO q12h for 6 weeks **PLUS** Rifampicin (15mg/kg) PO q24h for 6 weeks **OR** Rifampicin (15 mg/kg) PO q24h for 6 weeks **PLUS** Gentamicin 5mg/kg IV q24h for 7 - 10 days	For children > 8 yr: Refer adult regime
5. Leptospirosis			
L. icterohaemorrhagiae, L. canicola Moderate to severe disease	Benzylpenicillin 100,000 units/kg IV q6h for 7 days	Ceftriaxone 80-100mg/kg IV q24h fo 7 days	

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
Mild disease	Amoxicillin 20-50mg/kg PO q6h-q8h for 7 days	**OR** Cefotaxime 150-200mg/kg/24h IV in 4 divided doses for 7 days For children > 8 yr: Doxycycline 4mg/kg PO q12h for 7 days	
6. Tetanus	Refer to Neonatal Infections Section		
7. Melioidosis			
Burkholderia pseudomallei Intensive/Induction therapy: Maintenance therapy:	Ceftazidime 200mg/kg/24h IV q6h for 10-14 days Amoxycillin (60/mg/kg/24h)/ Clavulanate PO q8h **OR** Trimethoprim/ Sulfamethoxazole 8mg/kg PO q12h Duration: 12-20 weeks	For children > 8 yr: Imipenem 75-100mg/kg/24h IV q6-8h **OR** Meropenem 75mg/kg/24h IV q8h	Parenteral treatment should be used for at least 10-14 days or until clear improvement is noted Folic Acid 5mg PO q24h to be given for patient on Trimethoprim/ Sulfamethoxazole
8. Malaria			
Plasmodium falciparum *a)Uncomplicated*	Artesunate /Mefloquine 5 - 8kg, 6 -11 mths: 25/55mg PO q24h	Riamet® (1 tablet: Artemether/ lumefantrine 20/120mg)	Artesunate /Mefloquine available as FDC tablet: 25/55mg and 100/220mg

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
	9 - 17kg, 1-6 yr : 50/110mg PO q24h 18 - 29kg, 7-12 yr: 100/220mg PO q24h ≥30kg, >13 yr : 200/440mg PO q24h for 3 days	The patient should receive an initial dose, followed by 2nd dose 8 hours later, then 1 dose q12h for the following 2 days 5- <15kg : 1 tab per dose 15 - <25kg: 2 tab per dose 25 - <35kg: 3 tab per dose ≥35kg : 4 tab per dose	Artesunate /Mefloquine may cause seizure in children with epilepsy 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
b) Treatment failure	An alternative ACT regimen to be used. (eg: If Riamet® is used as the first line regimen, so the choice will be Artesunate /Mefloquine and vice versa) Refer above for dosing	Artesunate 4mg/kg PO q24h **PLUS** Clindamycin 10mg/kg PO q12h for 7 days **OR** Quinine 10mg salt/kg PO q8h **PLUS** Clindamycin 10mg/kg PO q12h for 7 days	Lumefantrine absorption is enhanced by co-administration with fat containing food or milk Primaquine 0.75mg base/kg to be given on Day 1 as a single dose in addition to ACT (check G6PD status before use).
c) Complicated - Almost always due to *P. falciparum* - Always suspect mixed infections if *vivax / knowlesi* malaria appear more severe than usual	D1: Artesunate 2.4 mg/kg IV on admission, then repeat again at 12h D2-7: Artesunate 2.4 mg/kg IV q24h or switch to oral ACT	D1: Quinine loading dose 7mg/kg IV over 1 hour, followed by 10mg/kg in 250ml D5% over 4 hours **OR** D1: Quinine loading dose 20mg/kg IV in 250ml D5% over 4 hours Then, D2-7: Quinine 10mg/kg IV q8h on	Parenteral artesunate should be given for a minimum of 24h or until patient is able to tolerate orally and thereafter to complete treatment with a complete course of oral ACT (ASMQ or Riamet). Change tol Quinine PO if able to tolerate orally. (Maximum Quinine per dose = 600mg.) Reduce quinine IV dose by one third of total dose if unable to change to quinine PO after 48hours or in renal failure or

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
		day 2 -7 **PLUS** For children >8yr: Doxycycline 3.5mg/kg PO q24h for 7 days **OR** For children <8yr: Clindamycin 10mg/kg PO q12h for 7 days	liver impairment Reference: CPG Malaria, MOH 2013
Plasmodium vivax a)New infection	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 q24h D3: 5mg base/kg PO q24h **PLUS** Primaquine 0.5mg base/kg PO q24h for 14 days		Check G6PD status before giving Primaquine. G6PD deficiency: Primaquine 0.75mg base/kg q7d for 8 weeks If severe *P.vivax*, treatment is as complicated *P.falciparum*
b)Chloroquine resistant or relapse	Riamet® (dosing as per *P.falciparum treatment*) **PLUS** Primaquine 0.5mg/kg PO q24h for 14 days	Quinine 10mg salt/kg PO q8h for 7 days **PLUS** Primaquine 0.5mg/kg PO q24h for 14 days	Reference: CPG Malaria, MOH 2013
Plasmodium malariae/ knowlesi	Chloroquine PO (dosing as per *P.vivax*)		If severe *P.vivax*, treatment is as complicated *P.falciparum*
Mixed Infection	Treat as *P.falciparum*		

References:
1. WHO Guidelines for the treatment of malaria 2006. WHO/HTM/MAL/2006.1108
2. Watt G, Padre LP, Tuazon ML, et al. Placebo-controlled trial of intravenous penicillin for severe and late leptospirosis. Lancet 1988; 1:433-5
3. Panaphut T. Ceftriaxone compared with sodium penicillin G for treatment of severe leptospirosis. Clin Infect Dis 2003; 36:1507-13
4. Suputtamongkol Y. An Open, Randomized, Controlled Trial of Penicillin, Doxycycline, and Cefotaxime for Patients with Severe Leptospirosis. Clin Infect
5. Dis 2004; 39:1417-24
6. Suputtamongkol Y. Amoxycillin -clavulanic acid treatment of melioidosis. Trans R Soc Trop Med Hyg 1991; 85:672-5
7. White NJ. Melioidosis. Lancet 2003; 361:1715-22
8. Silpapojakul K. Paediatric scub typhus in Thailand: a study of 73 confirmed cases. Trans R Soc Trop Med & Hygiene 2004;98:354-9
9. Guidelines for the Diagnosis, Management, Prevention and Control of Leptospirosis in Malaysia, MOH 2011.
10. Cheng AC, Chierakul W, Chaowagul W, et al. Consensus guidelines for dosing of amoxicillin-clavulanate in melioidosis. Consensus guidelines for dosing of amoxicillin-clavulanate in melioidosis. Am J Trop Med Hyg. 2008;78(2):208
11. Phimda K et al. Doxycycline versus azithromycin for treatment of leptospirosis and scrub typhus. Antimicrob Agents Chemother. 2007;51(9):3259

TUBERCULOSIS INFECTION IN CHILDREN

1. First-line AntiTB Drugs

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

Drug	Recommended Daily Dose	
	Dose (range) in mg/kg	**Maximum dose in mg**
Isoniazid (H)[b]	10 (10 - 15)	300
Rifampicin (R)	15 (10 - 20)	600
Pyrazinamide (Z)	35 (30 - 40)	2000
Ethambutol (E)	20 (15 - 25)[c]	1000

a. Source: Malaysia Health Technology Assessment Section, Clinical Practice Guideline Management of Tuberculosis 3rd edition 2012.
b. Pyridoxine 5 - 10mg/day needs to be added if isoniazid is prescribed.
c. The recommended daily dose of Ethambutol is higher in children (20mg/kg) than in adults (15mg/kg), because the pharmacokinetics is different. A systematic review showed that ethambutol can be used safely in children, especially in situations where it is possible to monitor the complications (particularly optic neuritis) regularly.
d. Streptomycin should be reserved for the treatment of multi-drug resistant tuberculosis in children with known drug susceptibility to this medicine.

2. Treatment Regimens

- Treatments have 2 phases, an initial intensive phase and a second continuation phase.
- Daily directly observed therapy is recommended for treatment of active disease
- During the continuation phase of treatment, thrice-weekly regimens can be-considered for children known to be HIV-uninfected and living in settings with-well-established directly-observed therapy (DOT)
- Use of steroids:
  - Corticosteroids should be used in tuberculous meningitis or pericarditis.
  - 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

Table 2: Recommended treatment regimens for children in each TB diagnostic category

TB cases	Regimen*		Remarks
	Intensive phase	**Continuation phase**	
New smear positive PTB **New smear negative PTB** **Less severe EPTB**	2HRZ	4HR	Ethambutol can be added in the intensive phase of suspected isoniazid-resistance or extensive pulmonary disease cases.
Severe concomitant HIV disease	2HRZE	4HR	
Severe form of EPTB **TB meningitis/ spine/bone**	2HRZE	10HR	

TB cases	Regimen*		Remarks
	Intensive phase	**Continuation phase**	
Previously treated smear positive PTB including relapse and treatment after interruption	3HRZE	5HRE	All attempt should be made to obtain culture and sensitivity result. In those highly suspicious of MDR-TB, refer to paediatrician with experience in TB management.
Treatment failure TB			Refer to paediatrician with experience in TB management.
MDR-TB	Individualised regimen		
***Direct observation of drug ingestion is recommended especially during the initial phase of treatment and whenever possible during the continuation phase.**			

PTB= pulmonary tuberculosis, EPTB= extrapulmonary tuberculosis, MDR-TB = multidrug-resistant tuberculosis

Source: Clinical Practice Guideline Management of Tuberculosis 3rd edition 2012. (Modified from World Health Organization. Rapid advice - treatment of tuberculosis in children. Geneva: WHO; 2006 & World Health Organization. Guidance for national tuberculosis programmes on the management of tuberculosis in children. Geneva: WHO; 2006)

References:
1. Malaysia Health Technology Assessment Section, Clinical Practice Guideline Management of Tuberculosis 3rd edition 2012
2. World Health Organization. Rapid advice - treatment of tuberculosis in children. Geneva: WHO; 2010
3. World Health Organization. Guidance for national tuberculosis programmes on the management of tuberculosis in children. Geneva: WHO; 2006
4. Donald PR, Maher D, Maritz JS, et al. Ethambutol dosage for the treatment of children: literature review and recommendations. Int J Tuberc Lung Dis. 2006 Dec;10(12):1318-30

URINARY TRACT INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Acute cystitis *E. coli* *Proteus* spp	Cefuroxime 30 mg/kg IV q12h (max 1gm/day) PO for 5-7 days	Nitrofurantoin 6mg/kg PO q6h (max 100mg) for 5-7days	Amoxycillin/Clavulanate and Trimethoprim are alternative for acute cystitis Note: single dose of antibiotic therapy not recommended. Empirical antibiotic choices guided by local organism resistant pattern
Acute pyelonephritis *E. coli* *Proteus* spp	Cefotaxime 50 mg/kg IV q8h **OR** Ceftriaxone 50-75 mg/kg q24h	Cefuroxime 50 mg/kg IV q8h **OR** Gentamicin 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 3-4 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 For infants and children with recurrent UTI	Trimethoprim 1-2mg/kg PO nocte	Nitrofurantoin 1-2mg/kg PO nocte	Antibiotic prophylaxis should not be routinely recommended in children with first-time UTI Prophylactic antibiotics should be given for 3 days with MCUG (Micturating Cystourethogram) taking place on the second day

References:
1. The Cochrane Database of Systematic Reviews
2. NICE Guidelines: Urinary tract infection: diagnosis, treatment and long term management of urinary tract infection in children 2007
3. UTI Clinical Practise Guideline, Pediarics 2011
4. Frank Shann (2014) Drug doses, Intensive Care Unit Royal Children's Hospital, Australia 16th Edition.

VASCULAR INFECTIONS

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	**Alternative**	
Catheter Related Blood Stream Infection			
S. epidermidis(CoNS) *S. aureus* MSSA	<u>For infant and children:</u> Vancomycin 10-15 mg/kg/day IV q6h Cloxacillin IV 100-200 mg/kg/day q6h		Indication of catheter removal are similar to adult but benefit of catheter removal must be weight against the difficulties of obtaining alternate venous access. Traetment without catheter removal should be closely monitored clinically with additional blood culture; removed catheter if there is persistent or recurrent infection Antibiotic lock therapy should be used for catheter salvage in combination with conventional antibiotic therapy for 10-14 days. S.aures may required longer course up to 4-6 weeks Exact optimal duration of therapy has not established in children with or without catheter removal. 10-14 days after first negative blood culture is usually recommended. Fungaemia: treatment without catheter removal associated with low success rate and higher mortality
Candida albicans or Other *Candida* species	Fluconazole 6-12 mg/kg IV q24h	For children 3 months-17 years: Caspofungin loading dose 70 mg/m^3/day IV on day 1 followed by 50 mg/ m^3/day thereafter (max 70mg)	
Gram –ve bacilli (*E.coli*, *Enterobacter, Klebsiella, Pseudomonas, Acinetobacter*) ESBL –ve ESBL +ve	 (Cetriaxone/Cefotaxime/Ceftazidime) **PLUS/MINUS** Aminoglycoside Imipenem 60-100mg/kg/day IV q6h **OR** Meropenem 20mg/kg IV q8h		
Suppurative thrombophlebitis			

Infection/Condition & Likely Organism	Suggested Treatment		Comments
	Preferred	Alternative	
S. aureus MSSA MRSA	Cloxacillin 100-200mg/kg/day IV q6h Vancomycin 10-15 mg/kg/day IV q6h		Diagnosis require positive blood culture plus radiographic demonstration of thrombus Removed catheter and minimum of 3-4 weeks of antibiotics. Surgical resection of involved vein if failed conservative therapy

References:
1. IDSA Guidelines for Intravascular Catheter-Related Infection • CID 2009;49:1-45
2. Patricia MF. Diagnosis and Management of Central-Venous Catheter-Related Bloodstream Infections in Pediatric Patients. Pediatr Infect Dis J. 2009;28(11):1016-1017
3. Michael JS, Catheter Related Bloodstream Infection In Children. Am J Infect Control 2008;36:S173.e1-S173.e3.

APPENDICES

CLINICAL PHARMACOKINETIC GUIDELINES
(UPDATED ON 10th Nov 2014)

AMINOGLYCOSIDE DOSING STRATEGIES

A. EXTENDED-INTERVAL THERAPY / SINGLE DAILY DOSING (EID/SDD)

EID/SDD is an approach of giving high-dose aminoglycoside over 30 minutes at an extended interval (e.g 24 hourly, 36 hourly or more).

The theoretical benefits of EID/SDD:

- Aminoglycosides display concentration-dependent bactericidal action-that is, higher dose and serum concentrations result in more rapid bacterial killing. [1]
- Optimise concentration-dependent bacterial killing by achieving a high peak (>10x MIC).[2]
- Minimize nephrotoxicity by administering larger, less frequent doses and potentially decreasing renal cortical aminoglycoside concentrations.
- Utilize the post-antibiotic effect (PAE)(2-8 hours), defined as a recovery period before organisms can resume growth after drug removal.[1]
- Minimize the development of adaptive resistance by allowing a recovery period during the dosing interval.

Exclusion criteria;

EID/ SDD is reasonable in most patients, with the following exceptions:[3]

- Pregnancy
- Ascites
- Burns (>20%)
- Endocarditis
- Creatinine clearance <30ml/min
- Dialysis
- Neutropenic patients
- Patients with gram positive infections (synergistic effect).
- Heamodynamically unstable.
- History of hearing loss/vestibular dysfunction.
- Mycobacterium infection.

SDD Dosing Strategy Based On Creatinine Clearance:[4]

Creatinine Clearance (ml/min)	Dose in 24 hours	
	Gentamicin	Amikacin
> 80	5mg/kg	15mg/kg
60 -79	4mg/kg	12mg/kg
40 – 59	3.5mg/kg	7.5mg/kg
30 – 39	2.5mg/kg	4mg/kg
< 30	Conventional dosing	Conventional dosing

EID Dosing Strategy Based On Serum Concentration:[5]

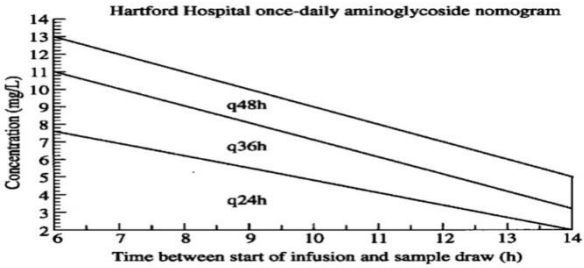
Gentamicin	Amikacin
7mg/kg per dose	15mg/kg per dose

1. Initial level monitoring*

Single level drawn 8-12 hours after the first dose (Only applicable for 7 mg/kg– plotting doses lower or higher than 7 mg/kg may under or overestimate clearance)

Concentration Gentamicin (7 mg/kg/dose): Plot level on graph
Concentration Amikacin (15 mg/kg/dose): Divide level in half, then, plot on graph

Please consult pharmacist for dosage adjustment.



2. Follow up trough level monitoring

Trough monitoring (30-60 minutes prior to dose) should be considered in patients demonstrating acute changes in renal function or suspicion of extended interval failure

Maintenance trough levels should be monitored at least once weekly

Sample Parameters	Gentamicin		Amikacin	
Time to sample[10]	At the 2nd dose			
Sampling time[10]	Take two samples at minimum 4 hours interval (e.g. post-2H and post-6H)			
Target levels (mcg/ml)[5,6]	TROUGH	PEAK*	TROUGH	PEAK*
	<1	16-30	<1	56-64

*The target reference range may be individualized based on institutional MIC value.

B. CONVENTIONAL / TRADITIONAL DOSING

Tradition dosing includes reduced doses and frequent administration of aminoglycosides using pharmacokinetic parameters to determine dose and frequency.

Creatinine Clearance (ml/min)	Gentamicin	Amikacin
>60[7]	1.5 – 2mg/kg every 8 hourly	5 – 7.5mg/kg every 8 hourly
40 - 60[7]	1.5 – 2mg/kg every 12 hourly	5 – 7.5mg/kg every 12 hourly
20 -40[7]	1.5 – 2mg/kg every 24 hourly	5 – 7.5mg/kg every 24 hourly
<20[7]	1.5 – 2mg/kg every 48 – 72 hourly	5 – 7.5mg/kg every 48 – 72 hourly
CVVH/ CVVHD/ CVVHDF[8]	Loading dose 3mg/kg followed by 2mg/kg every 24 – 48 hourly	Loading dose 10mg/kg followed by 7.5mg/kg every 24 – 48 hourly
CAPD[9]	Intermittent: 0.6mg/kg in night dwell Continuous: Loading dose 8mg/L followed by 4mg/L	Intermittent: 2mg/kg in night dwell Continuous: Loading dose 25mg/L followed by 12mg/L

Sample Parameters	Gentamicin		Amikacin	
Time to sample[10]	After the 3rd dose			
Sampling time[10]	**PRE:** obtained just prior to the next dose **OR** within 30 minutes before the next dose **POST:** 30 minutes after completion of 30 minutes infusion **OR** Bolus: 1 hour after dose is given			
Sampling time for ESRF[11]	PRE dialysis			
Target levels (mcg/ml)[6,10]	**TROUGH**	**PEAK***	**TROUGH**	**PEAK***
	<2	5 -10	<10	20 -30

*The target reference range may be individualized based on institutional MIC value.

VANCOMYCIN DOSING STRATEGIES

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.

Sample Parameters[12]	Recommendation[12]
Time to sample	Just before the 4th dose.
Optimal trough concentration– non-complicated infections	Mininum trough concentration should always be maintained above 10mg/L (10-20mg/L) to avoid development of resistance. For a pathogen with an MIC of 1mg/L, the minimum trough concentration would have to be at least 15mg/L to generate the target AUC:MIC of 400.
Optimal trough concentration – complicated infections **(bacteremia, endocarditis, osteomyelitis, meningitis, and hospital-acquired pneumonia cased by *Staphylococcus aureus*)**	Trough concentration of 15-20mg/L is recommended to improve penetration, increase the probability of obtaining optimal target serum concentrations and improve clinical outcomes.

Vancomycin Dosing Strategy For Intermittent Infusion:

Renal Function	Dose
Normal[12]	2 – 3 g/day (20 – 45 mg/kg/day) in divided doses every 6 – 12 h; Max *4g*/day Obese: Dose based on TBW
Clcr > 50 ml/min[13]	15-20mg/kg/dose every 12 hours (usual : 750 – 1500 mg)
Clcr 20 – 49 ml/min[13]	15-20mg/kg/dose every 24 hours (usual : 750 – 1500 mg)
Clcr< 20 ml/min[13]	Need longer intervals, determine by serum concentration monitoring
HD[13]	Following loading dose of 15-20mg/kg, given 500mg to 1000mg after each dialysis session. Pre dosing based on pre-HD level*: <10mg/L: administer 1000mg after HD 10-25 mg/L: administer 500-750mg after HD >25mg/L: Hold vancomycin *based on clinical judgement
CVVH[13]	Following loading dose of 15-20mg/kg, give 1g every 48 hours
CVVHD / CVVHDF[13]	Following loading dose of 15-20mg/kg, give 1g every 24 hours
CAPD[9]	**Intermittent dose (once/day):** 15-30 mg/kg every 5-7 days **Continuous dose (per/L exchange):** Loading :1000mg/L Maintenance : 25mg/L

Vancomycin dosing strategy for continuous infusion [14,15] :

Body weight	Loading Dose
< 40kg	500mg IV in 100 mls 0.9% sodium chloride or 5% glucose over 1 hour
< 70 kg	1 g IV in 250 mls 0.9% sodium chloride or 5% glucose over 2 hours
≥ 70 kg	1.5 g IV in 250 mls 0.9% sodium chloride or 5% glucose over 2.5 hours

Start the maintenance IV infusion immediately after the loading dose. The dose depends on the patient's renal function. Infusions should be administered in 250 ml 0.9% sodium chloride or 5% glucose over 12 hours. The total daily dose should be split into two and the infusion rate set at 20.8 ml/hr.

Creatinine Clearance* (ml/min)	Daily maintenance dose	Dose in each 250 mls infusion bag for administration over 12 hours
<20	500 mg	250 mg
20-34	750 mg	375 mg

35-59	1000 mg	500 mg
60-79	1500 mg	750 mg
80-99	2000 mg	1000 mg
>100	2500 mg	1250 mg

REFERENCES:

1. Bennett WM, Plamp CE, Gilbert DN, Parker RA, Porter GA. The influence of dosage regimen on experimental gentamicin nephrotoxicity: dissociation of peak serum levels from renal failure. J Infect Dis 1979; 140:576-580
2. Freeman C.D. et al. Once daily dosing of aminoglycosides: review and recommendations for clinical practice. Journal of antimicrobial chemotherapy (1997) 39, 677-686
3. Once-Daily Dosing of Aminoglycosides, A consensus Document. 1997. Nasr Anaizi. Obtained from www.rxkinetics.com/oda.html on 23 May 2011
4. The Sanford Guide to Antimicrobial Therapy 2014 (Forty-fourth edition)
5. Hartford Hospital Once Daily Aminoglycoside nomogram.
6. Bauer LA 2006.Clinical Pharmacokinetics Handbook. Chapter 4 : Aminoglycoside Antibiotic. New York. McGraw Hill.
7. Guide to Antimicrobial Therapy in the Adult ICU 2012.
8. Robin T et.al. Antibiotic Dosing In Critically Ill Adult Patients Receiving Continuous Renal Replacement Therapy. Clinical Infectious Disease 2005:41:1159-1166
9. ISPD Guidelines/Recommendation-Peritoneal Dialysis-Related Infections Recommendations: 2010 Update. Peritoneal Dialysis International, Vol 30,402.
10. Winter ME.2010.Basic Clinical Pharmacokinetics 5th Edition. Philadelphia. Lippincott Williams and Wilkins.
11. Clinical Pharmacokinetics : Pharmacy Handbook 1st Edition.
12. Rybak M et al 2009. Therapeutic Monitoring Of Vancomycin In Adult Patients : A Consensus Review Of The American Society of Health-System Pharmacists, the Infectious Diseases Society of America, and the Society of Infectious Disease Pharmacists. AMJ Health-SYST Pharm. Vol 66: 82-98
13. Drug Information Handbook 23rd Edition.
14. Intravenous Vancomycin Use In Adults (Continuous Infusion). NHS, Scottish Antimicrobial Prescribing Group.
15. Davis G et al. Vancomycin Continuous Infusion Guidelines For Used In The Intensive Therapy Unit. NHS Tayside, Ninewells Hospital.

Appendix 2 : Antibiotic Dosages In Patients With Impaired Renal Function (Adult)

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 DIALYSIS	COMMENTS
		> 50	10-50	< 10		
ANTIBACTERIAL						
Aminoglycoside: Traditional multiple daily doses - adjustment for renal disease						
Amikacin	7.5mg/kg q12h	100% q12h or 24hr	100% q24-72h by levels	100% q48h-72h by levels	HD: Extra 1/2 of normal renal function dose AD PD: 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. Reference Sanford G/line 2014
Gentamicin,	1.7mg/kg q8h	100% q8-24h	100% q12-48h by levels	100% q48-72h by levels	HD: Extra 1/2 of normal renal function dose AD PD: 3-4mg/L/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	HD: Extra 1/2 of normal renal function dose AD PD: 3-4mg lost/L dialysate/day	
Streptomycin	15mg/kg (max. of 1gm) q24h	q24h	q24-72h	q72-96h	HD: Extra 1/2 of normal renal function dose AD PD: 20-40mg/L/day	
Carbapenem						
Imipenem	250-1000mg q6h	100%	50%	25%	HD: Dose AD	Increase potential for seizures if recommended

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
					PD: Dose for CrCl <10	doses exceeded in patients with CrCl<20 ml/min. Refer package insert for patients <70 kg
Meropenem	1-2gm q8h	100%	100% q12h	100% q24h	HD: Dose AD PD: Dose for CrCl <10	
Ertapenem	1gm q24h	100%	100%	50%	PD : Dose for CrCl <10	
Cephalosporin: DATA ON SELECTED PARENTERAL **CEPHALOSPORINS**						
Cefazolin	250mg-2000mg q6h	100% q8h	100% q12h	50% q24-48h	HD : 15-20mg/kg AD PD : 0.5gm q12h	
Cefepime	250-2000mg q8h – q12h	100%	50-100% q24h	25-50% q24h	HD : Dose for CrCl<10 PD: Dose for CrCl<10	
Cefotaxime	1-2gm q6-12h	q6h	q6-12h	q24h or ½ dose	HD : 0.5-2gm AD PD : 1gm/d	Active metabolite of cefotaxime in ESRD. Reduce dose further for hepatic & renal failure
Cefoperazone/ Sulbactam	2mg q12h	2gm q12h	2gm q12h	1gm q12h	Only sulbactam component affected by hemodialysis. Dosing scheduled following dialysis period	Ref : Drug pres 4th
Ceftazidime	1-2gm q8h	q8-12h	q12-24h	q24-48h	HD: Extra 1g AD PD: 0.5g/d	
Cefuroxime sodium	0.75-1.5gm q8h	q8h	q8-12h	q24h	HD: Dose AD PD: Dose for CrCl <10	
Cefuroxime axetil	250mg-500mg q12h	100%	100%	100%	HD: Dose AD PD: None	
Fluoroquinolone						
Ciprofloxacin	500-750mg PO (or 400mg IV) q12h	100%	50-75%	50%	HD: 250mg PO or 200mg IV q12h PD:250mg PO or 200mg IV q8h	
Levofloxacin	250mg-750mg q24h	100%	250-750mg q24-48h	250-500mg q48h	HD & PD : Dose for CrCl <10	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
			(500-750mg initial dose)	(500mg initial dose)		
Ofloxacin	200-400mg q12h	200-400mg q12h	200-400mg q24h	200mg q24h	HD: 100-200mg AD PD: Dose for CrCl <10	
Macrolide						
Clarithromycin	0.5-1gm q12h	100%	75%	50-75%	HD: No data. Dose AD PD: None	ESRD dosing recommendations based on extrapolation
Erythromycin	250-500mg q6h	100%	100%	50-75% 100%	HD/PD : None	**Rare ototoxicity with high doses in ESRD**
Miscellaneous Antibacterials						
Colistin						Recommendations are evolving : depending institution
Linezolid	600mg PO/IV q12h	600mg q12h	600mg q12h	600mg q12h AD	HD : No dose adjustment PD : No dose adjustment	Accumulation of 2 metabolites - risk unknown
Metronidazole	250-500mg q8-12h	100%	100%	100%	HD: Dose AD PD: Dose for CrCl <10	HEMO clears metronidazole and its metabolites
Nitrofurantoin	50-100mg q6h	Avoid < 60	Avoid	Avoid	HD & PD : Not applicable	
Sulfamethoxazole	1gm q8h	q12h	q18h	q24h	HD: Extra 1g AD PD: 1gm/d	
Trimethoprim	100mg q12h	q12h	q12h >30m/min, q18 for 10-30ml/min	q24h	HD: Dose AD PD: Dose for CrCl <10	New hemodialysis membranes K clear off 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, 1gm for 7-10 days.
Vancomycin	500mg-1.25gm q12h	1g q12 -24h	1g q24-96h	1gm q4-7d 1gm stat then follow blood	HD/PD: Dose for CrCl <10	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
				level		
Polymyxin B						Recommendations are evolving : depending institution
Penicillins						
Amoxycillin, Ampicillin	250-500mg q8h 250mg-2gm q6h	q8h q6h	q8-12h q6-12h	q24h q12-24h	HD: Dose AD PD: 250mg q12h	
Amoxycillin/ Clavulanate	500/125mg q8h	500/125mg q8h	250-500mg AM component q12h	250-500mg AM component q24h	HD: As for CrCl <10; extra dose after dialysis	
Ampicillin/ Sulbactam	2gm AM + 1g SB q6h	q6h	8-12h	q24h	HD: Dose AD PD: 2gm AM / 1g SB q24h	
Benzylpenicillin	0.5-4 million U q4-6h	100%	75%	20-50%	HEMO: Dose AD CAPD: Dose for CrCl <10	1.7 mEq potassium/mU. Increase potential for seizures. 10mU/d upper limit dose in ESRD.
Piperacillin	3-4gm q6h	q6h	q6-12h	q12h	HD : 2gm q 8h plus 1g after HD PD : Dose for CrCl <10	1.9 mEq sodium/g
Pip(P) / Tazo(T)	3.375 -4.5gm q6 -8h	100%	2.25gm q6h (q8h if <20)	2.25g q8h	HD : Dose for CrCl <10, 1.125g after HD PD : 4.5gm q12h	
Tetracycline						
Tetracycline	250-500mg q6-12h	q8-12h	q12-24h	q24h	HD/PD: None	Avoid in ESRD
ANTIFUNGAL						
Amphotericin B & ampho B lipid complex ABCC : Ampho B Cholesteryl Complex ABCD : Ampho B colloidal dispersion ABLC : Ampho B lipid Complex LAB : Liposomal	0.3-1.5 mg/kg/d ABCC/ABCD :3-6mg/kg/d ABLC: 5mg/kg/d LAB: 3-5mg/kg/d	q24h	q24h	q24hr	HD: None PD: Dose for CrCl <10	Toxicity lessened by sodium loading. If nephrotoxicity occurs, increase dosing interval or preferably change to a lipid amphotericin product.

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
Ampho B						
Fluconazole	100-400mg q24h	100%	50%	50%	HD: 100% Dose AD PD: Dose for CrCl <10	
Itraconazole PO	100-200mg q12h	100%	100%	100%	HEMO/CAPD: No adjustment with oral solution	
Itraconazole IV	200mg q12h	200mg q12h	Do not use IV itraconazole if CrCl less 30ml/min due to accumulation of carrier : Cyclodextrin			
Flucytosine	37.5mg/kg q6h	q12h	q12-24h	q 24-48h	HD : Dose AD PD : 0.5-1gm/d	Hepatic dysfunction. Marrow suppression more common in azotemia patients
Voriconazole, IV	6mg/kg IV q12h x 2 doses. Then, 4mg/kg q12h	100%	If CrCl <50 ml/min, accumulation of IV vehicle (cyclodextrin). Switch to PO or suspension (no dose adjustment).			
Voriconazole PO	200mg PO q12h	100%	100%	100%	HD & PD : No adjustment necessary	
ANTIPARASITIC						
Pentamidine IV	4mg/kg q24h	q24h	q24h	q24-36h	HD : Dose CrCl <10, 0.75gm after each dialysis PD : Dose CrCl <10	Nephrotoxic
ANTIMYCOBACTERIAL						
Ethambutol	15-25mg/kg q24h	q24h	q24-36h	q48h	HD: Dose AD HD: 15 to 25 mg/kg 3 times per week after dialysis PD: Dose for CrCl <10	Decrease visual acuity. Alternative dose , 25mg/kg 4-6 hrs prior to dialysis for usual 3x/week dialysis.
Isoniazid	5mg/kg q24h (max 300mg)	100%	100%	100%	HD: Dose AD PD: Dose for CrCl <10	Supplement with pyridoxine 50-100mg daily to prevent neurotoxicity
Pyrazinamide	25mg/kg q24h (max. dose 2.5gm q24h)	25mg/kg q24h	25mg/kg q24h	12-25mg/kg q24h	CAPD: No reduction Alternative dose of 25-30mg/kg after 3x/week HD.	
Rifampin	600mg q24h	600mg q24h	300-600mg q24h	300-600mg q24h	HD: None PD: Dose for CrCl <10	Biologically active metabolite.
Ethionamide	250-500mg q12h	100%	100%	50%	No dosage adjustments	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
ANTIVIRAL						
Acyclovir, IV	5-10mg/kg q8h	100% q8h	100% q12-24h	50% q24h	HD: Dose AD PD: Dose for CrCl <10	Rapid IV infusion can cause renal failure.
Adefovir	10mg PO q24h	10mg q24h	10mg q48-72h	10mg q72h	HD: 10mg q7d AD PD : No data	
Ganciclovir	Induction: 5mg/kg q12h IV	CrCl ≥70: 5mg/kg q12h CrCl 50-69: 2.5mg/kg q12h	CrCl 25-49: 2.5mg/kg q24h CrCl 10-24: 1.25mg/kg q24h	1.25mg/kg 3x/wk	HD: Dose for CrCl<10 AD	
	Maintenance 5mg/kg q24h IV	CrCl ≥70: 5mg/kg q24h CrCl 50-69: 2.5mg/kg q24h	CrCl 25-49: 2.5mg/kg q24h CrCl 10-24: 1.25mg/kg q24h	0.625mg/kg 3x/wk	HD : 0.625mg/kg 3x/wk AD PD: Dose for CrCl <10	
Valganciclovir	Induction: 900mg q12h	CrCl ≥60: : 900mg q12h CrCl 40-59: 450mg q12h	CrCl 25-39: 450mg q24h CrCl 10-24: 450mg q48h	Avoid (use adjusted dose of ganciclovir)		
	Maintenance: 900mg q24h	CrCl ≥60: : 900mg q24h CrCl 40-59: 450mg q24h	CrCl 25-39: 450mg q48h CrCl 10-24: 450mg 2x/wk	Avoid (use adjusted dose of ganciclovir)		
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 150mg-300mg q12-24h	100%	50-150mg q24h (full first dose)	25-50mg q24h (50mg first dose)	HD: Dose AD PD: No data. Dose for CrCl <10	Refer CPG HIV
Lamivudine (HepB)	100mg PO q24h	**30-49 ml/min**	**15-29 ml/min**	**5-14 ml/min** 35mg 1st	< 5 ml/min: 35mg 1st dose, then 10mg q24h. HD/ PD: No dosage adjustment or additional dose.	

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			SUPPLEMENT FOR DIALYSIS	COMMENTS
		> 50	10-50	< 10		
		100mg 1st dose, then 50mg q24h	100mg 1st dose,then 25mg q24h	dose, then 15mg q24h		
Ritonavir & Saquinavir, SGC	Negligible renal clearance. At present, no patient data. Avoid oral solution due to propylene glycol content.					
Stavudine, PO	≥60kg: 40mg q12h <60kg: First dose: 40mg q12h Second dose 30mg q12h	100%	50% q12-24h	>60kg: 20mg/d <60kg: 15mg/d	HD: Dose as for CrCl <10 AD PD: No data	
Zidovudine	200mg q8h. Second dose 300mg q12h	100%	100%	100mg q8h	HEMO: 100mg q8h AD CAPD: Dose for CrCl <10 HD: Dose for CrCl <10 PD: 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, SGC=Soft gel capsule, HD – Hemodialysis, PD – Peritoneal dialysis						

Reference :

1. Drug prescribing in renal failure, 5th Edition (George R. Aronoff et all)
2. The Sanford Guide to Antimicrobial Therapy 2014 (44th edition)
3. Micromedex (On line)
4. Lexi com (On Line)

Appendix 3 : Antibiotic Dosages in Children With Impaired Renal Function

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
ANTIBACTERIAL						
Aminoglycosides: Single daily dose						
Amikacin	LD 20mg/kg IV MD 15mg/kg IV q24h Max 1.5gm/d	Take trough level before the 2nd dose. If trough level is high, recheck level 12 hours after that level was taken. Redose when trough level is in range; adjust dosing interval accordingly.		15mg/kg on D1 then take blood level on D3; adjust dosing interval accordingly. See comment for HD dosing.		a) High flux hemodialysis membranes may lead to unpredictable aminoglycoside clearance, measure post- dialysis drug levels for efficacy (Peak) and toxicity (Trough). Refer level range in TDM section. b) Dosing adjustment for overweight for grossly eodematous patients: [IBW + 0.4(ABW-IBW)] IBW: Ideal body weight ABW: Actual body weight c) Where possible dosage modifications should be based on monitoring of individual pharmacokinetic
Gentamicin **Netilmicin**	LD 7mg/kg IV MD 5mg/kg IV q24h Max 240-360mg/d			5mg/kg on D1 then take blood level on D3; adjust dosing interval accordingly. See comment for HD dosing.		
Streptomycin	15mg/kg/dose IM q24h Max 1gm/d	7.5mg/kg q24h	7.5mg/kg q48h	7.5mg/kg q72-96h		TDM level monitoring is currently not available locally
Carbapenem						
Imipenem (+cilastatin)	15-25mg/kg/dose IV q6h	7-13 mg/kg/dose q8h	7-13 mg/kg/dose q12h	7-13 mg/kg/dose q24h		
Meropenem	20-40mg/kg q8h Increase up to 40mg/kg in severe infection. Max 6gm/day	100% q12h	50% q12h	50% q24h		
Cephalosporin						
Cefazolin	10-15mg/kg/dose (max 1g/dose) q8h Severe infection 50mg/kg/dose, max 2gm/dose q6h	q8h	q12h	q24h		
Cefepime	25mg/kg q12h Severe infection 50mg/kg q8h	q24h	q24h	q48h		
Cefotaxime	25mg/kg q8h	q8-12h	q12h	q24h		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
Injection 500mg, 1gm, 2gm	Severe infection 50mg/kg q4-6h					
Ceftriaxone **Injection 250mg, 1gm, 2gm**	**Infection** **Neonates** **20-50mg/kg IV** **>1mo** 20-50mg/kg IV/IM q24h (increase to 80mg/kg infusion for severe infection or meningitis). Max 4gm/day **Prophylaxis of meningococcal meningitis∞** **1 – 12yo** **125mg IM single dose (in 1% lignocaine)** **>12yo** 250mg IM single dose (in 1% lignocaine)	100%	100%	Dose should not exceed 40mg/kg/day (max 2gm/day)		a) Should not be administered to premature, acidotic, jaundiced neonates or those with impaired liver function (e.g. prematurity, acute/chronic liver failure). b) Administration time in neonates in over 60 minutes to reduce risk of bilirubin encephalopathy. c) Doses over 80mg/kg may increase risk of biliary precipitates. d) Incompatible with calcium containing solutions and must not be given simultaneously with calcium containing solutions – even in different infusion lines.
Cefoperazone/Sulbactam						
Ceftazidime **Injection 500mg, 1gm**	**Infection** IV/IM injection **<2mo** **30mg/kg q12h (50mg/kg q12h for meningitis)** **≥2mo** 30-50mg/kg q8-12h Doses up to 50mg/kg q8h (max 2gm q8h) may be given in severe infection, immunocompromised or cystic fibrosis. Single dose over 1gm should not be given via IM.	q12h	q24h	q48h		
Cefuroxime **Injection 250mg, 750mg, 1.5gm** **Caplet 125mg, 250mg** **Liquid**	**Infection** **Neonates** **30mg/kg IV q12h** **Infants/ Children** 10-30mg/kg q8h **Severe infection/ Cystic fibrosis** **Neonates** **50mg/kg IV q12h; reduce to 25mg/kg q12h on clinical**	100%	q12h	q24h		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
	improvement **Infants/ Children** 50-60mg/kg q6-8h **Prophylaxis for cardiothoracic surgery for 24h** **All ages 30mg/kg on induction followed by 2nd dose after 12h**					
Fluoroquinolone						
Ciprofloxacin **Injection 100mg, 250mg** **Tablet 100mg, 250mg** **Liquid 250mg/5ml**	**Severe infection** **Neonates 10-15mg/kg q12h IV/PO** **1mo – 18yo** 10-15mg/kg (max 400mg) q12h IV 10mg/kg (max 750mg) q12h PO **Cystic fibrosis** **All ages 15-20mg q12h** **Prophylaxis for meningococcal disease** **6 – 12yo 250mg as a single dose PO** **<12yo** 500mg as a single dose PO	100%	50% q12h	50% q24h		
Levofloxacin	**<5yo 10-15mg/kg q12h IV/PO** **>5yo** 5-10mg/kg q24h IV/PO	100%	5-10mg/kg q24h	5-10mg/kg q24h		
Ofloxacin	5mg/kg q8-12h IV/PO 10mg/kg q12h IV/PO	7.5mg/kg q24h	7.5mg/kg q24h	7.5mg/kg q48h		IV infusion over 1 hour
Macrolide						
Clarithromycin	7.5-15mg/kg q12h PO Slow release tablet: 0.5gm or 1gm q24h	100%	4mg/kg q12h	4mg/kg q24h		
Erythromycin	**Infection** **Infants (>2mo) / 10mg/kg q6h**	100%	100%	q8h		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
Injection 1gm Tablet 250mg, 500mg Liquid 125mg/5ml, 250mg/5ml	**Children** **Severe infection** **Infants (>2mo)/ Children 15 – 25 mg/kg q6h** **Rheumatic Fever** **Infants (>2mo)/ Children NOT /kg 250 mg q12h** **GUT Prokinetic** **Infants (>2 mo)/ Children 2 mg/kg q8h**					
Miscellaneous antibacterials						
Colistin	**IV** **All ages 40,000unit/kg or 1.25 – 2.5 mg/kg of colistin base q12h** **PO or inhalation** **All ages 30,000 – 60,000unit/kg q8h**					
Linezolid	**Infants/ Children 10mg/kg IV q8h (max 600mg)**	100%	100%	100%		Recommended treatment duration in 10-14 days, maximum 28 consecutive days
Metronidazole	**All ages 15mg/kg stat, 7.5 mg/kg IV/PO q12h (MD) to start 48H after loading dose (LD) in Preterm, 24H in term). MD q8h for neonate> 4 weeks**	100%	100%	100%		Metronidazole is rapidly removed by HD and CAPD, therefore dose should be administered post dialysis.
Nitrofurantoin	**Infection** **All ages 1.5mg/kg IV q6h** **Prophylaxis** **All ages 1-2mg/kg at night**	Avoid use in Crcl <60ml/min/1.73m^2				
Sulfamethoxazole	**Trimethoprim component** **Infection**					

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
	All ages 4mg/kg IV/PO q12h **Prophylaxis for Renal** **All ages 2mg/kg PO OD**					
Trimethoprim	**Infection** **All ages 4mg/kg IV/PO q12h** **Severe infection** **All ages 6 - 8mg/kg IV/PO q12h** **Prophylaxis for Urine** **All ages 2mg/kg PO OD**					
Vancomycin	**Infection** LD 25mg/kg IV MD 15 - 20mg/kg IV q8-12h Max 30gm/d **Prophylaxis for Surgery** **All ages 25mg/kg over 90 min ending just before procedure**	q12h	q24h	15mg/kg every 4-7 days. Check level on day 3. Redose when trough level is in range; adjust dosing interval accordingly.		
Polymyxin B	**Infection** **< 2 yo 15,000 – 45,000 units/kg/day continuous IV infusion or IV q12h** **> 2 yo** 15,000 – 25,000 units/kg/day continuous IV infusion or IV q12h Max: 2,000,000 units/day					**Avoid parenteral route when possible**
Penicillin						
Amoxycillin, Ampicillin		100%	q12h	q24h		
Amoxycillin/ Clavulanate	**Infection** **All ages 15 – 25mg/kg q8h** **Severe infection**	100%	q12h	q24h		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
	All ages 50mg/kg q8h					
Ampicillin/ Sulbactam	**Infection** **Infants > 1mo/ children 25 - 50mg/kg q6h** **Severe infection/ Meningitis** **Infants > 1 mo/ children 50 - 100mg/kg q6h**	q8h	q12h	q24h		
Benzylpenicillin (C-Penicillin)	**Infection** **Neonates 50,000 units/kg IV q12h** **Infants/ Children** 25,000 – 50,000/kg/day q4-6h **Severe infection** **Neonates 80,000 units/kg IV q12h** **Infants/ Children** 25,000 – 80,000/kg in q4-6h			q8h		1Mu is approximately 1.6gm
Piperacillin	**Infection** **< 6 mo 100mg/kg IV q8h** **> 6 mo** 100mg/kg IV q6-8h **Severe infection** Same as above but as continuous infusion	q8h	q12h	q12h		
Pip(P) / Tazo(T)	**Use Piperacillin component** ***As* Piperacillin**	q6h	q8h	q8h		
Tetracycline						
Tetracycline	**>8 yo NOT /kg: 250 – 500 mg q8h**					
ANTIFUNGAL						
Amphotericin B & ampho B lipid complex	**Amphotericin B** **All Ages 1.5 - 2mg/kg continuous IV q** **Amphotericin B Lipid Complex**	100%	100%	100%		

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
	Infant/ children **3 – 6 mg/kg IV over 2h q24h**					
Fluconazole	**Infection** **Neonates** **5 - 6mg/kg IV q72h (age<14 days); q48h (age 15 – 28 days); q24h (age> 28 days)** **Infants/ Children** 6 mg/kg stat, 3 - 12mg/kg q24h **Severe infection/ Cystic fibrosis** **Neonates** **6 - 12mg/kg IV q72h (age<14 days), q48h (age 15 – 28 days), q24h (age> 28 days)** **Infants/ Children** 6 - 12mg/kg q24h	q24h	q24h	q48h		Oral product bioavailability is as good as IV product.
Itraconazole PO	All ages 3-5mg/kg q12h	100%	100%	100%		
Flucytosine	400 - 1200mg/m² q6h PO					
Voriconazole, IV	**Oral** **<40kg** **9mg/kg q12h** **>40kg** Load 400mg q12h x 2 doses, then 200-300mg q12h. **IV injection** **<40kg** **Load 9mg/kg q12h x 2 doses, then 8mg/kg q12h** **>40kg** Load 6mg/kg q12h, then 3-4mg/kg q12h	100%	100%	100%		
ANTIPARASITIC						
Pentamidine Injection 200mg	3 - 4 mg/kg/dose IV/IM q24h for 10 – 14 days	100%	q36h	q48h		
Ethambutol Tab 400mg	25mg/kg q24h PO	100%	q36h	q48h		
Isoniazid Tablet 100mg Liquid 50mg/5ml	10mg/kg q24h PO (max 300mg)	100%	100%	100%		
Pyrazinamide Tablet 500mg	35mg/kg q24h PO (max 2000mg)	100%	40mg 3x/week	40mg 3x/week		
Rifampin	15mg/kg q24h PO (max 600mg)					

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
Capsule 150mg, 300mg **Liquid 100mg/5ml**						
Ethionamide **Tablet 250mg**	15 – 20 mg/kg q24h PO (max 1000mg) at night					
ANTIVIRAL						
Acyclovir **Injection 250mg** **Tablet 200mg, 800mg**	**EBV, herpes encephalopathy or sepsis, immunodeficiency, varicella** **>35wk – 12y 500mg/m² IV q8h** **Varicella zoster** **<2y 400mg (NOT/kg) x 5/day for 7 days** **≥2y** 800mg (NOT/kg) x 5/day for 7 days	q12h	q24h	50% q24h		
Adefovir **Tablet 10mg**	**2-6 yo 0.3mg/kg q24h PO (max 10mg)** **7-11 yo** 0.25mg/kg q24h PO (max 10mg) **>12 yo** 10mg q24h PO (max 10mg)					
Ganciclovir **Injection 250mg**	5 mg/kg IV q12h for 2-3 weeks, then 5 mg/kg IV q24h 20 mg/kg PO q8h	2.5mg/kg IV day 1, then 1.25mg/kg q24 **OR** 100% PO	1.25mg/kg IV day 1, then 0.625mg/kg q24 **OR** 30mg/kg q12h PO	1.25mg/kg IV 3x/week, then 0.625mg/kg 3x/week **OR** 30mg/kg q24h PO		
Indinavir/ Nelfinavir/ Nevirapine **Indinavir** **Tab 400mg** **Nevirapine** **Tab 200mg** **Liquid 50mg/5ml**	Indinavir: 500 mg/m² q8h PO Nelfinavir: 45-55 mg/kg PO q12h or 25-35 mg/kg PO q8h Nevirapine: **<8 yo 200mg/m² q24h PO (max 200mg)** **>8 yo** 120-150 mg/m² q24h PO (max 200mg)					

ANTIMICROBIAL	DOSE FOR NORMAL RENAL FUNCTION	ADJUSTMENT FOR RENAL FAILURE Estimated creatinine clearance (CrCl), ml/min			HD IP PD	COMMENTS
		30-50	**10-29**	**< 10**		
Lamivudine(HIV) Liquid 10mg/ml	**< 30 days** **2mg/kg q12h PO** **> 30 days** 4mg/kg q12h PO	q24h	q24h	q24h		
Lamivudine (Hep B) Liquid 10mg/ml	2-7 yo 3mg/kg q24h PO (max 100mg)	q24h	q24h	q24h		
Ritonavir & Saquinavir, SGC **Ritonavir Tablet & capsule 100mg Saquinavir Capsule 200mg, tab 500mg**	**5-14kg** **RTV 3mg/kg + SQV 50mg/kg q12h PO** **15 - 39kg** RTV 2.5mg/kg + SQV 50mg/kg q12h PO **>40kg** RTV 100mg + SQV 50mg/kg q12h PO					
Stavudine, PO Tab 30mg	**<14 days** **0.5mg/kg q12h PO** **<30kg** 1mg/kg q12h PO **30-59kg** 30mg q12h PO	<30kg: 0.5mg/kg q12h 30-59kg: 15mg q12h	<30kg: 0.25mg/kg q24h 30-59kg: 7.5mg q24h	<30kg: 0.25mg/kg q24h 30-59kg: 15mg q24h		
Zidovudine Capsule 100mg Liquid 10mg/ml	180 - 240 mg/m^2 q12h PO 120 mg/m^2 q6h IV	100%	100%	50% q8h		

Appendix 4 : Antibiotic in Pregnancy and Lactation

Types of Antibiotics/ Antiviral/ Antiviral/Anti TB	FDA Pregnancy category	Compatibility with Breastfeeding (Reference: Therapeutic Goods Administration;TGA)
Abacavir	C	Avoid , insufficient data Compatible, may cause diarrhea in infant
Acyclovir	B	Compatble
Adefovir	C	Avoid , insufficient data
Amikacin	D	Compatible, may cause diarrhea in infant
Amoxycillin	B	Compatible; may cause diarrhea in infant
Amoxycillin / Clavulanate	B	Compatible; may cause diarrhea in infant
Amphotericin B	B	Compatible
Ampicillin	B	Compatible; may cause diarrhea in infant
Ampicillin / Sulbactam	-	No data available
Artesunate	NA	Caution, insufficient data
Azithromycin	B	Compatible; may cause diarrhea in infant
Bacampicillin	B	No data available
Benzathine Penicillin	B	Compatible; may cause diarrhea in infant
Benzylpenicillin	B	Compatible; may cause diarrhea in infant
Caspofungin	C	Caution, insufficient data
Cefaclor	B	Compatible; may cause diarrhea in infant
Cefepime	B	Compatible; may cause diarrhea in infant
Cefoperazone	B	Infant risk cannot be ruled out
Cefoperazone / Sulbactam	-	No data available
Cefotaxime	B	Compatible; may cause diarrhea in infant
Ceftazidime	B	Compatible; may cause diarrhea in infant
Ceftriaxone	B	Compatible; may cause diarrhea in infant
Cefuroxime Axetil	B	Compatible; may cause diarrhea in infant
Cefuroxime Sodium	B	Compatible; may cause diarrhea in infant
Cephalexin Monohydrate	B	Compatible; may cause diarrhea in infant
Chloramphenicol	C	oral or IV use: avoid Topical use; compatible
Ciprofloxacin	C	Compatible; may cause diarrhea in infant
Clarithromycin	C	Compatible; may cause diarrhea in infant
Clindamycin	B	Compatible; may cause diarrhea in infant
Clofazimine	C	Avoid , insufficient data
Clotrimazole	B	Compatible
Cloxacillin	B	Compatible; may cause diarrhea in infant
Cycloserine	C	No data available
Dapsone	C	Caution, insufficient data;monitor for haemolysis, do not use in infants with G6PD deficiency
Didanosine	B	Avoid , insufficient data
Doxycycline	D	Compatible for short courses (eg 10 days) if alternative drug not appropriate; may cause diarrhea in infant
Efavirenz	C	Avoid , insufficient data
Ertapenem	B	Compatible; may cause diarrhea in infant
Erythromycin	B	Compatible; may cause diarrhea in infant
Ethambutol	C	Compatible
Fluconazole	D	Compatble
Flucytosine	C	Caution, insufficient data
Fusidate sodium	C	Compatible; may cause diarrhea in infant
Ganciclovir	C	Avoid , insufficient data

Types of Antibiotics/ Antiviral/ Antiviral/Anti TB	FDA Pregnancy category	Compatibility with Breastfeeding (Reference: Therapeutic Goods Administration;TGA)
Gentamicin	C (Ophthalmic / Otic/Aural / Topical/Cutaneous) D (parenteral)	Compatible; may cause diarrhea in infant
Griseofulvin	C	Avoid , insufficient data
Imipenem / Cilastatin	C	Compatible; may cause diarrhea in infant
Indinavir	C	Avoid, insufficient data
Isoniazid	C	Compatible
Itraconazole	C	Caution, insufficient data
Kanamycin	D	No data available
Ketoconazole	C	systemic use: caution, insufficient data topical use: compatible
Lamivudine	C	Avoid , insufficient data
Levofloxacin	C	Compatible; may cause diarrhea in infant
Linezolid	C	Caution, insufficient data; may cause diarrhea in infant
Lopinavir / Ritonavir	C	Avoid , insufficient data
Meropenem	B	Compatible; may cause diarrhea in infant
Metronidazole	B	Compatible; may cause diarrhea in infant
Miconazole	C	Compatible
Minocycline	D	Avoid, Possibility of staining infant's teeth with prolonged coursres
Netilmicin	D	
Nevirapine	C	Avoid , insufficient data
Nitrofurantoin	B	Compatible; may cause diarrhea in infant
Nystatin	C	Compatible
Ofloxacin	C	Compatible
Phenoxymethyl penicillin	B	Compatible; may cause diarrhea in infant
Piperacillin	B	Compatible; may cause diarrhea in infant
Piperacillin / Tazobactam	Piperacilin –B, Tazobactam -unknown	Compatible; may cause diarrhea in infant
Procaine Benzylpenicillin	B	Compatible; may cause diarrhea in infant
Pyrazinamide	C	Caution, insufficient data
Ribavirin	X	Avoid, insufficient data
Rifampicin	C	Compatible; may cause diarrhea in infant. Monitor infant for jaundice
Ritonavir	B	Avoid, insufficient data
Stavudine	C	Avoid, insufficient data
Streptomycin	D	Caution, insufficient data; may cause diarrhea in infant
Sulphamethoxazole / Trimethoprim	D	Compatible in infants older than one month; may cause diarrhea in infant
Terbinafine HCL	B	Compatible in infants older than one month; may cause diarrhea in infant
Tetracycline	D	Compatible for short courses (eg 10 days) if alternative drug not appropriate; may cause diarrhea in infant
Tinidazole	C	Caution, insufficient data; may cause diarrhea in infant
Trimethoprim	C	Compatible
Vancomycin	C	Compatible; may cause diarrhea in infant
Voriconazole	D	Avoid, insufficient data
Zidovudine	C	Avoid, insufficient data

Definitions for compatibility with breastfeeding:

compatible—there are sufficient data available to demonstrate an acceptably low relative infant dose and/or no significant plasma concentrations and/or no adverse effects in breastfed infants
caution—there are insufficient data showing low relative infant dose and/or no significant plasma concentrations and/or no adverse effects in breastfed infants
avoid, insufficient data—there are no data on transfer into milk, or on plasma concentrations or adverse effects in the breastfed infant
avoid—significant plasma concentrations in exposed infants, or adverse effects in breastfed infants reported or predictable from the properties of the molecule.

In Australia, breastfeeding is not recommended for HIV-positive women because of the possibility of HIV transmission and because suitable formula milk is readily available. In countries in which no acceptable, feasible, sustainable and safe replacement feeding is available, exclusive breastfeeding for 6 months is recommended for HIV-infected mothers to reduce the risk of HIV transmission from the mother to the infant compared with mixed feeding. The amount of drug transferred via milk in these cases is also of interest as it may exert antiviral actions in the infant.

Appendix 5 : Antifungal Activity Spectrum

DRUG	ORGANISMS INHIBIT / CLINICAL SYNDROMES		
	Yeast	**Mould**	**Dimorphic Fungi**
POLYENES			
Amphotericin B • **Conventional** • **Ampho B lipid complex (ABLC)** • **Ampho B cholesteryl Complex** • **Liposomal Ampho B**	*Candida albicans* *Candida tropicalis* *Candida parapsilosis* *Candida glabrata* *Candida krusei* *Candida dubliniensis* *Candida guillermondil* *Cryptococcus neoformans*	*Aspergillus fumigatus* *Aspergillus flavus* (higher MIC but ABLC has greater activity) **Mucorales* **Fusarium species* (better with ABLC) (resistant is common) **Trichosporon* spp (least active clinically) *Mucormycosis* (with ABLC)	*Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis* *Sporothrix schenoki*
Nystatin	*Candida* spp. *Cryptococcus* spp	*Aspergillus* spp	*Blastomyces* spp. *Coccidioides* spp. *Histoplasma capsulatum*
PYRAMIDINE ANALOG			
5-Flucytosine	**Candida albicans* **Candida tropicalis* **Candida parapsilosis* **Candida krusei* **Candida glabrata* **Cryptococcus neoformans* (resistant is common)		
AZOLES			
Ketoconazole	*Candida* spp.	*Dematiaceous molds*	*Blastomyces dermatitidis* *Histoplasma capsulatum* *Coccidioides immitis*
Fluconazole	*Candida albicans* *Candida dubliniensis* *Candida tropicalis* *Candida parapsilosis* *Candida guillermondil*		**Histoplasma capsulatum* (least active clinically) **Blastomyces dermatitidis* (least active clinically)

DRUG	ORGANISMS INHIBIT / CLINICAL SYNDROMES		
	Yeast	**Mould**	**Dimorphic Fungi**
	**Candida lusitaniae* (least active clinically) **Candida glabrata* (possibly active but resistant is common) *Cryptococcus neoformans*		
Itraconazole	*Candida albicans* *Candida dubliniensis* *Candida tropicalis* *Candida parapsilosis* *Candida guillermondil* **Candida krusei* (least active clinically) **Candida glabrata* (resistant is common) **Cryptococcus neoformans* (least active clinically)	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* **Fusarium* species (possibly active) **Trichosporon* spp (least active clinically) *Dematiaceous molds*	*Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis* *Sporothrix schenoki*
Voriconazole	*Candida albicans* *Candida dubliniensis* *Candida tropicalis* *Candida parapsilosis* *Candida guillermondil* *Candida krusei* *Candida lusitaniae* **Candida glabrata* (resistant is common) *Cryptococcus neoformans*	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* *Fusarium* species *Scedosporium aplospermum* *Trichosporon* spp *Mucormycosis* *Dematiaceous molds*	*Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis*
Posaconazole	*Candida albicans* *Candida dubliniensis* *Candida tropicalis* *Candida parapsilosis* *Candida krusei* *Candida guillermondil* *Candida lusitaniae* **Candida glabrata* (resistant is common)	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* *Mucorales* *Fusarium* species *Scedosporium aplospermum* *Trichosporon* spp *Mucormycosis* *Dematiaceous molds*	*Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis* **Sporothrix schenoki* (least active clinically)

DRUG	ORGANISMS INHIBIT / CLINICAL SYNDROMES		
	Yeast	Mould	Dimorphic Fungi
	Cryptococcus neoformans		
ECHINOCANDIN			
Anidulafungin	*Candida albicans* *Candida dubliniensis* *Candida glabrata* *Candida tropicalis* *Candida krusei* *Candida lusitaniae* **Candida parapsilosis* (high MIC) **Candida guillermondil* (high MIC)	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* *Dematiaceous molds* (least active clinically)	
Caspofungin	*Candida albicans* *Candida dubliniensis* *Candida glabrata* *Candida tropicalis* *Candida krusei* *Candida lusitaniae* **Candida parapsilosis* (high MIC) **Candida guillermondil* (high MIC)	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* *Dematiaceous molds* (least active clinically)	
Micafungin	*Candida albicans* *Candida dubliniensis* *Candida glabrata* *Candida tropicalis* *Candida krusei* *Candida lusitaniae* **Candida parapsilosis* (high MIC) **Candida guillermondil* (high MIC)	*Aspergillus fumigatus* *Aspergillus flavus* *Aspergillus terreus* *Dematiaceous molds* (least active clinically)	

Remarks :

1. Echinocandins, Voriconazole, Posaconazole and Polyenes have poor urine penetration.

2. Successful treatment of infection with *Candida parapsilosis* requires removal of foreign body or intravascular device.

3. Infections from mucormycosis,some *Aspergillus* spp., and dermaticeous molds often require surgical debridement.

References:
1. Russell E. Lewis. Current concept in antifungal pharmacology. Mayo Clin Proc. 2011;86(8):805-817 Doi: 10.4065/mcp. 2011.0247. www.mayoclinicproceedings.com
2. The Sanford Guide To Antimicrobial Therapy 2014. 44th Ed. Antimicrobial Therapy Inc. ISBN 978-1-930808-78-2

Appendix 6 : Guide To Collection & Transport Of Clinical Specimen

SPECIMEN	COLLECTION CONTAINER	TRANSPORT
Blood /Bone Marrow Aspirate	Commercial blood culture bottle (aerobe, anaerobe, paediatric, fungal, TB)	-
CSF	Sterile Bijou bottle	Immediately
Ear	Sterile swab	Amies Transport Medium
Eye	Sterile swab	Amies Transport Medium
	Corneal scrapping	Bacteriologic/Mycology culture media
Stool	Clean/Sterile container	Selenite F broth/Alkaline Peptone Water (during outbreak)
Stool for *Clostridium difficile* toxin	Sterile container	Immediately
Rectal swab (CRE/VRE screening)	Sterile swab	Amies Transport Medium
Genital	Sterile swab	Amies Transport Medium
Endocervical swab for *Chlamydia trachomatis*	Glass slide	Immediately or fixed with methanol if expected delay
Nose	Sterile swab	Amies Transport Medium
Sinus	Sterile swab	Amies Transport Medium
Bronchoalveolar lavage	Sterile container	Immediately
Sputum/Tracheal aspirate	Sterile container	-
Sterile body fluid (peritoneal/pericardial/pleural/ vitrous/synovial fluid)	Sterile container	Immediately
Throat	Sterile swab	Amies Transport Medium
Tissue	Sterile container filled with sterile normal saline (not formalin)	-
	Thioglycolate/RCMM for anaerobic infection	-
Urine	Sterile container	Within 30 minutes
Pus	Sterile swab	Amies Transport Medium
	Sterile container (aspirated from abscess)	-
	Thioglycolate/RCMM for anaerobic infection	-
Central venous catheter tip	Sterile container	Send along with peripheral blood culture
Gastric biopsy for *Helicobacter pylori*	Bullet tube filled with 0.5 ml sterile saline	Immediately
Blood film for malaria parasite (BFMP)	Thin & thick smear on glass slide	Immediately

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