SECOND EDITION 2023

# ANTIMICROBIAL GUIDELINE

HOSPITAL RAJA PERMAISURI BAINUN

# ANTIMICROBIAL GUIDELINE
# HOSPITAL RAJA PERMAISURI BAINUN
# SECOND EDITION
# 2023

Published by:
Antimicrobial Stewardship (AMS) Team, Hospital Raja Permaisuri Bainun

This guide can be downloaded from the
Hospital Raja Permaisuri Bainun website: hrpb.moh.gov.my

**FOREWORDS**

Antimicrobial resistance in disease pathogens has become a matter of great public health concern globally including in our country. The factors responsible for this are widespread use of all the antimicrobials across the country meant for human as well as animal consumption. Inappropriate selection of antimicrobials may lead to antimicrobial resistance, which is fast becoming a growing public health threat worldwide. Detecting, preventing and controlling antibiotic resistance requires sustained effort and engagement from all healthcare professionals.

I am happy to note that the Antimicrobial Stewardship Team of HRPB in collaboration with various departments in the hospital has produced the second antimicrobial guideline HRPB adapted to the local practice, thereby reducing the development of antimicrobial resistance. The guideline is important to provide guidance on the selection of antimicrobials to healthcare professionals.

I congratulate all the working members from various departments for their contribution in preparing this guideline. I hope that the healthcare professionals in HRPB would use these guidelines to the maximum for the benefit of the patients.

Thank you.

**DR. MEGAT ISKANDAR BIN MEGAT ABDUL HAMID (P.M.P)**
Director of Hospital Raja Permaisuri Bainun (HRPB)

**FOREWORDS**

As we all know, the use of antimicrobials in one person has the potential to affect the drug's efficacy in others, making the overuse of antimicrobials a public health problem not just hospital wide, nationwide but also a global wide issue. Inadequate infection prevention and control practice can further worsen the spread of antimicrobial resistance.

The practice of appropriate and judicious utilisation of antimicrobials is of utmost importance in order to improve patient outcomes and to reverse or slow down antimicrobial resistance. Hence, antimicrobial guidelines have always been used to provide guidance to healthcare personnels in the management of various infections. Our first *HRPB Antimicrobial Guideline* 2017 was published on the HRPB website. Now I am indeed honoured to introduce this new updated edition of *HRPB Antimicrobial Guideline* 2023. This edition sees some new and exciting changes done to the format and the content, making it more user friendly especially to the junior doctors.

This guideline was reviewed by relevant specialists from respective departments in HRPB. My heartfelt thank you goes to those who are involved and work hard to update this document despite their busy schedules.

This endeavour would not be possible without the tremendous efforts by our editorial team who worked diligently, from organising everything up to the final editing. I salute you all! I would like to thank the continuous support and trust from hospital top management, head of clinical departments and pharmacy.

Last but not least, I sincerely hope that our clinicians will find this updated guideline useful in their daily practice. Let's use antimicrobial wisely and prevent antimicrobial resistance together!

Thank you.

**DATO DR. KER HONG BEE**
Consultant Infectious Disease Physician
Department of Medicine
Hospital Raja Permaisuri Bainun (HRPB)

**FOREWORDS**

Overuse and misuse of antimicrobials have been associated with more rapid emergence of antimicrobial resistance. Therefore, promoting the appropriate use of antimicrobials through an updated guideline is important to reduce antimicrobial resistance and infections caused by multidrug resistant organisms.

The second edition of the *HRPB Antimicrobial Guideline* 2023 has been developed to suit the local practice. This guideline is adapted from the *National Antimicrobial Guideline* 2019. I hope it serves as a guiding tool to provide relevant information on the rational use of antibiotics. This guideline is intended to be used by all the healthcare professionals in HRPB.

I want to congratulate all who are involved for their commendable efforts in reviewing and updating this guideline. I hope this updated guideline will be implemented effectively to ensure rational use of antimicrobials, thereby reducing antimicrobial resistance.

Thank you.

**NORMI BT KAMARUZAMAN**
Head of Pharmacy Department
Hospital Raja Permaisuri Bainun (HRPB)

## WORKING COMMITTEE

**Advisors**

| | |
|---|---|
| Dr. Megat Iskandar bin Megat Abdul Hamid | Hospital Director |
| Ms. Normi bt Kamaruzaman | Chief Pharmacist |

**Infectious Disease Physicians**
Dato' Dr. Ker Hong Bee
Dr. Cheng Joo Thye
Dr. Steven Lim Chee Loon
Dr. Marsilla Mariaty binti Marzukie

**Infectious Disease Paediatrician**
Dr. Haema Shunmugarajoo

**Clinical Microbiologists**
Dr. Zahrul Laili binti Abd Hadi
Dr. Fong Kang Chyi @ Foong Kang Chyi

**Pharmacists**
Dr. Doris a/p George Visuvasam
Ms. Ros Sakinah Binti Kamaludin
Ms. Lee Pooi Mun
Mr. Ho Chee Wah
Ms. Wong Hong Yean
Ms. Voon Bee Peng
Ms. Siti Nur Sharida binti Abd Kadir
Mr. Cheah Meng Fei
Ms. Manimegahlai a/p Selvaratnam
Ms. Nurulhusna Syuhaidah bt Yusof
Ms. Thanushiapriya a/p Selva Raj
Ms. Lee Pei Jia
Ms. Kong Pui Chin
Ms. Liew Wei Mun
Ms. Choong Lai Yuan
Ms. Kuginesh a/p Ganapathy
Ms. Chow Li Wei
Ms. Chan Pooi Yee
Mr. Loo Yew Win
Mr. Nicholas Lee Chor Teng
Ms. Wan Alia Amalina bt Adenan
Ms. Hemalathah a/p Paramalingam
Ms. Lim Wan Lin
Ms. Madhuri a/p G. Sabapathy
Ms. Nur Atikah binti Basharuddin
Mr. Muhammad Azuan bin Azman
Mr. Ahmad Ayzat bin Ahmad Jaafar
Ms. Lai Qian Xin
Ms. Tan Rou Wei
Mr. Leow Hon Lunn
Ms. Intan Nurul'Ain bt Ismail
Ms. Kwek Lih Ling
Ms. Amutha Vaani a/p Vinthaikumaran
Ms. Ghaneshwari a/p Ramamuthie
Ms. K. Oganeswary a/p Kobi
Mr. Sathesh Kumar a/l Ramayah
Ms. Roseanna Prescilla a/p Ramakrishnan
Ms. Low Yuet Man
Ms. Malarvili a/p Manika Wasagam

## CONTRIBUTORS

**Surgery**
Ms. (Dr.) Elaine Ng Hui Been
Mr. (Dr.) L Sivaneswaran Lechmiannandan
Ms. (Dr.) Nurdaliza M Badaruddin

**Neurosurgery**
Ms. (Dr.) Neoh Yee Yik

**Plastic and Reconstructive Surgery**
Mr. (Dr.) Jeremiah See Un Chang

**Obstetrics and Gynaecology**
Dr. Kaamini a/p Planisamy
Dr. S. Hamsavahini a/p Sorano @ Soranam

**Orthopaedics**
Mr. (Dr.) Choo Tze Yong
Mr. (Dr.) Yap Khoon Sim

**Otorhinolaryngology**
Dr. Maithrea Suresh Narayanan
Dr. Benjamin Goh Hong Beng

**Ophthalmology**
Dr. Ummi Faradiana binti Abdul Rahim

**Dermatology**
Dr. Madiha binti Muhamad Sarkan

**Nephrology**
Dr. Loh Chek Loong
Dr. Thong Kah Mean

**Neurology**
Dr. Cheah Chun Fai

**Respiratory**
Dr. Kumaresh Raj a/l Lachmanan

**Oncology**
Dr. Angel Kwan Khor Nee

**Haematology**
Dr. Kamini a/p Kirubamoorthy

**Cardiovascular Infections**
Dr. Kwan Yew Fung

**Gastrointestinal Infections**
Dr. Tan Phei Oon

**Oral Health**
Dr. Yuen Kar Mun

**Paediatrics**
Dr. Chew Eng Lai

**Paediatric Dentistry**
Dr. Sumathy Perumal

**Microbiology**
Ms. Azlina binti Yahya
Ms. Husna binti Khairam

## TABLE OF CONTENTS


| Contents | Page |
|---|---|
| **SECTION A: ADULTS** | |
| Cardiovascular Infections | 10 |
| Central Nervous Infections | 19 |
| Gastrointestinal Infections | 28 |
| Infections in Immunocompromised Patients: | |
| A. Haematology/Oncology | 37 |
| B. Human Immunodeficiency Virus (HIV) | 44 |
| Obstetrics and Gynaecological Infections | 57 |
| Ocular Infections | 63 |
| Oral/Dental Infections | 73 |
| Otorhinolaryngology Infections | 82 |
| Respiratory Infections | 87 |
| Sexually Transmitted Infections | 92 |
| Skin and Soft Tissue Infections | 102 |
| Surgical Infections | 118 |
| Tropical Infections | 135 |
| Urinary Tract Infections | 144 |
| Infections In Patients On Long-Term Renal Replacement Therapy | 152 |
| Chemoprophylaxis | |
| A. Surgical | 157 |
| B. Non-surgical | 174 |
| **SECTION B: PAEDIATRICS** | |
| Cardiovascular Infections | 177 |
| Central Nervous Infections | 182 |
| Gastrointestinal Infections | 185 |
| Infections In Immunocompromised Patients | 190 |
| Neonatal Infections | 193 |
| Oral/Dental Infections | 199 |
| Otorhinolaryngology Infections | 201 |
| Respiratory Infections | 203 |
| Skin and Soft Tissue Infections | 205 |
| Surgical Infections | 208 |
| Tropical Infections | 211 |
| Tuberculosis in Children | 217 |

Urinary Tract Infections 219
Vascular Infections 221
Chemoprophylaxis
C. Surgical 224
D. Non-surgical 229

**APPENDICES**

Appendix 1: Antibiotic Resistance Data 239
Appendix 2: Antibiotic Utilisation Data 250
Appendix 3: Antimicrobial Dosages in Patients with Impaired Renal Function (Adults) 253
Appendix 4: Clinical Pharmacokinetics Guidelines (Aminoglycosides and Vancomycin) 266

# (SECTION A: ADULTS)

## CARDIOVASCULAR INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **INFECTIVE ENDOCARDITIS** | | | |
| **Empirical Treatment** | | | |
| Community-acquired native valves | Benzylpenicillin 18MU/day IV q4-6h<br>**OR**<br>Ampicillin 12g/day IV q4-6h<br><br>**PLUS**<br>Gentamicin 3mg/kg IV q24h<br><br>**PLUS/ MINUS**<br>*Cloxacillin 12g/day IV q4-6h | **Penicillin Allergy:**<br>Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose)<br>**PLUS**<br>Gentamicin 3mg/kg IV q24h | Treatment can be modified once the blood result is known.<br><br>*For patients with suspected *S. aureus* infections (such as IVDU or patients with prosthesis) and acute presentation. |
| Early PVE (<12 months post-surgery)<br>or nosocomial and non-nosocomial healthcare associated endocarditis | Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose)<br>**PLUS**<br>Gentamicin 3mg/kg IV q24h<br><br>**PLUS/ MINUS**<br>*Rifampicin 300-450mg PO q12h<br><br>**PLUS/MINUS**<br>**Cefepime 2g IV q8h | | *Rifampicin is only recommended for PVE and it should be started 3-5 days later than vancomycin and gentamicin.<br><br>**Cefepime is indicated if local epidemiology suggests for non-HACEK Gram-negative rod infections (such as *Pseudomonas*). |
| Late PVE (> 12months) | Ampicillin 12g/day IV q4-6hr<br>**PLUS**<br>Gentamicin 3mg/kg IV q24h | **Penicillin Allergy:** | *For patients with suspected *S. aureus* infections (such as IVDU or |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **PLUS/ MINUS**<br>*Cloxacillin 12g/day IV q4-6h | Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose)<br>**PLUS**<br>Gentamicin 3mg/kg IV q24h | patients with prosthesis) and acute presentation. |
| **Definitive Treatment**<br>(*Viridans streptococci* & *Streptococcus bovis*: It is recommended MIC estimation is done for these isolates to facilitate management) | | | |
| Native and Prosthetic Valves<br>MIC: < 0.125mg/L<br>Penicillin-susceptible viridans streptococci & *Streptococcus bovis* | Benzylpenicillin 3MU IV q4-6h<br>(or 12-18MU/day as continuous infusion) | Ampicillin 2g IV q4h<br>**OR**<br>Ceftriaxone 2g IV/IM q24h<br><br>**Penicillin Allergy:**<br>Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) | Duration of therapy:<br>4 weeks (native valves)<br>6 weeks (prosthetic valves)<br><br>Penicillin-susceptible viridans streptococci, monotherapy with benzylpenicillin, ampicillin or ceftriaxone is adequate. |
| Native Valves and Prosthetic Valves<br>MIC > 0.125mg/L- 2mg/L<br>Penicillin-relatively resistant viridans streptococci & *Streptococcus bovis* | *Benzylpenicillin 4MU IV q4h or 24MU IV as continuous infusion<br>**PLUS**<br>**Gentamicin 3mg/kg IM/IV q24h | *Ceftriaxone 2g IV/IM q24h<br>**PLUS**<br>**Gentamicin 3mg/kg IV/IM q24h<br><br>**Penicillin Allergy (immediate-type):**<br>*Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose)<br>**PLUS**<br>**Gentamicin 3mg/kg IV/IM q24h | *Duration of therapy:<br>4 weeks (native valves)<br>6 weeks (prosthetic valves)<br><br>**Penicillin-relatively resistant viridans streptococci, gentamicin has to be added to regime;<br>2 weeks (native valves)<br>6 weeks (prosthetic valves)<br><br>**Gentamicin pre-dose (trough): <1mg/L |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Native Valves & Prosthetic Valves<br>MIC > 2mg/L<br>Penicillin-relatively resistant viridans streptococci & *Streptococcus bovis* | Treat as resistant enterococcal endocarditis | | |
| Nutritionally variant *Streptococci* (NVS)<br>*Abiotrophia defectiva* and *Granulicatella species,* both formerly known as NVS | Ampicillin 2g IV q4h for 6 weeks<br>**PLUS**<br>Gentamicin 1mg/kg IV q8h for 2 weeks<br>**OR**<br>Benzylpenicillin 4MU IV q4h (or 24MU IV as continuous infusion)<br>for 6 weeks<br>**PLUS**<br>Gentamicin 1mg/kg IV q8h for 2 weeks | Ceftriaxone 2g IV/IM q24h for 6 weeks<br>**PLUS**<br>Gentamicin 1mg/kg IV q8h for 2 weeks<br><br>**Penicillin Allergy (immediate-type):**<br>Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) for 6 weeks | NVS are fastidious and slow growing making it technically difficult to determine antimicrobial susceptibility. |
| **Definitive Treatment** (*Enterococcus* species) | | | |
| Native and Prosthetic Valves (sensitive to gentamicin)<br>MIC ≤8mg/L<br>Fully penicillin-susceptible strains | Ampicillin 2g IV q4h<br>**PLUS**<br>*Gentamicin 1mg/kg IM/IV q8h | | Duration of symptoms < 3 months and native valves:<br>Ampicillin duration - 4 weeks<br>Gentamicin duration - 2 weeks<br><br>Duration of symptoms > 3 months or prosthetic valves:<br>Ampicillin duration - 6 weeks<br>Gentamicin duration - 6 weeks<br><br>*To maximize synergistic effect, administer gentamicin at the same |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | time or temporally close to ampicillin/penicillin. |
| Native and Prosthetic Valves (sensitive to gentamicin) (renal impairment and elderly) | Ampicillin 2g IV q4h for 6 weeks<br>**PLUS**<br>Ceftriaxone 2g IV q12h for 6 weeks | | |
| Native and Prosthetic Valves Sensitive to penicillin and vancomycin but high level resistance to gentamicin (MIC > 500mg/L) | Ampicillin 2g IV q4h for 6 weeks<br>**PLUS**<br>*Ceftriaxone 2g IV q12h for 6 weeks | | *Ceftriaxone should not be used alone for *enterococcus* infection, as they are intrinsically resistant.<br><br>This combination is not active against *E. faecium.* |
| Native and Prosthetic Valves Resistant to penicillin and susceptible to aminoglycosides and vancomycin | Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) for 6 weeks<br>**PLUS**<br>*Gentamicin 1mg/kg IV/IM q8h for 6 weeks | | *Gentamicin pre-dose (trough): <1mg/L |
| **Definitive Treatment (***Staphylococcus aureus)* | | | |
| Native Valves Methicillin-susceptible staphylococci (MSSA) | Left sided endocarditis or complicated right sided endocarditis:<br><br>Cloxacillin 2g IV q4h for 4- 6 weeks | Both left-sided and right sided:<br><br>**Immediate-type penicillin allergy:**<br>Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) for 4- 6 weeks<br><br>**Non-immediate type hypersensitivity:** | Vancomycin is inferior to cloxacillin for treatment of MSSA. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | Cefazolin 2g IV q8hr for 4- 6weeks | |
| Native Valves<br>Methicillin-susceptible staphylococci (MSSA) | Right sided endocarditis (tricuspid valve) in uncomplicated endocarditis:<br>Cloxacillin 2g IV q4h for 2- 4 weeks | | 2-week regime is sufficient provided the patient fulfils all the following criteria:<br>● MSSA<br>● Good response to treatment<br>● Absence of metastatic sites of infection or empyema<br>● Absence of cardiac and extracardiac complications<br>● Absence of associated prosthetic valve or left-sided valve infection<br>● <20mm vegetation<br>● Absence of severe immuno-suppression (<200 CD4 cells/mL) with or without AIDS |
| Native Valves<br>Methicillin-resistant staphylococci (MRSA) | Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) for 4-6 weeks | *Daptomycin 10mg/kg IV q24h for 4-6 weeks | *Daptomycin is superior to vancomycin for MRSA bacteremia with vancomycin MIC > 1mg/L<br><br>*Daptomycin requires special medicine approval |
| Prosthetic Valves<br>Methicillin-susceptible staphylococci (MSSA) | Cloxacillin 2g IV q4h for ≥ 6 weeks<br>**PLUS**<br>Rifampicin 300-450mg PO q12h for ≥ 6 weeks<br>**PLUS**<br>Gentamicin 1mg/kg IM/IV q8h for 2 weeks | Regimen for β-lactam allergic patients:<br><br>**Immediate type hypersensitivity to penicillin:**<br>Vancomycin 25-30mg/kg IV loading dose. then 15-20mg/kg/dose IV q8-12h (actual | Rifampicin has better penetration, however, it should be started after 3-5 days of effective initial cloxacillin therapy and/or once the bacteraemia has been cleared to avoid resistance. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | body weight, not to exceed 2g/dose) for 4- 6 weeks<br><br>**OR**<br><br>**For non-immediate type hypersensitivity**: Cefazolin 2g IV q8h for 4- 6 weeks | Gentamicin can be given in a single daily dose in order to reduce renal toxicity |
| Prosthetic Valves Methicillin-resistant staphylococci (MRSA) | Vancomycin 25-30mg/kg IV loading dose, then 15-20mg/kg/dose IV q8-12h (actual body weight, not to exceed 2g/dose) for ≥ 6 weeks<br>**PLUS**<br>Gentamicin 1mg/kg IM/IV q8h for 2 weeks<br>**PLUS**<br>*Rifampicin 300-450mg PO q12h for ≥ 6 weeks | | *Rifampicin has better penetration, however, it should be started after 3-5 days of effective initial vancomycin therapy and/or once the bacteraemia has been cleared to avoid resistance. |
| **Definitive Treatment**<br>HACEK Microorganisms *(Haemophilus parainfluenzae, Aggregatibacter aphrophilus, Aggregatibacter actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella kingae)* | | | |
| Native and Prosthetic Valves | Ceftriaxone 2g IV/IM q24h for 4 weeks (native valve) or 6 weeks (prosthetic valve) | Ampicillin/sulbactam 3g IV q6h for 4 weeks (native valve) or 6 weeks (prosthetic valve)<br>**OR**<br>*Ciprofloxacin 400mg IV q12h or 500mg PO q12h for 4 weeks (native valve) or 6 weeks (prosthetic valve) | *Fluoroquinolones can be switched to appropriate oral doses if patients can tolerate oral medications. |
| **Definitive Treatment** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Non-HACEK Gram-negative microorganisms (eg. *Pseudomonas aeruginosa, Escherichia coli* and *Salmonella*) | | | |
| *Pseudomonas* Endocarditis | Piperacillin-tazobactam 4.5g IV q6h<br>**PLUS**<br>Gentamicin 5-7mg/kg IV q24h<br>for 6 weeks<br><br>**OR**<br><br>Piperacillin-tazobactam 4.5g IV q6h<br>**PLUS**<br>Amikacin 15mg/kg IV q24h<br>for 6 weeks | Cefepime 2g IV q8h<br>**OR**<br>Ceftazidime 2g IV q8h<br><br>**PLUS**<br>Gentamicin 5-7mg/kg IV q24h<br>**OR**<br>Amikacin 15mg/kg IV q24h<br>**OR**<br>Cefepime 2g IV q8h<br>**OR**<br>Ceftazidime 2g IV q8h<br><br>**PLUS**<br>*Ciprofloxacin 400mg IV q8h | Choice of antimicrobials depends on antimicrobial susceptibility patterns. Often needs to be combined with cardiac surgery.<br><br>*Fluoroquinolones can be switched to appropriate oral doses if patients can tolerate oral medications. |
| **Definitive Treatment:** *Candida* | | | |
| Native and Prosthetic Valves | Amphotericin B deoxycholate 0.6-1mg/kg IV q24h<br>**OR**<br>Lipid formulation Amphotericin B 3-5mg/kg IV q24h<br><br>**PLUS/ MINUS**<br>*Flucytosine 25mg/kg PO q6h<br><br>for at least 6 weeks after surgery | Micafungin 150mg IV q24h<br>**OR**<br>Caspofungin 150mg q24h<br>**OR**<br>Anidulafungin 200mg IV q24h<br><br>for at least 6 weeks after surgery | Valve replacement is mandatory. Continue therapy for 6 weeks after replacement or longer in patients with perivalvular abscess.<br><br>If prosthetic valve cannot be replaced, lifelong suppressive therapy with fluconazole 400mg (6mg/kg) daily is recommended. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Duration of therapy depends on the patient's response and surgical intervention and should be referred to an ID physician.<br><br>*For synergistic effect, causes dose related marrow toxicity, avoid using in patients with renal failure. |
| **Definitive Treatment:** Other microorganisms | | | |
| *Brucella spp.* | Doxycycline 100mg PO q12h<br>**PLUS**<br>Rifampicin 300-600mg PO daily<br><br>**PLUS**<br><br>*Streptomycin 15mg/kg IM q24h<br>**OR**<br>*Gentamicin 5mg/kg IV 24h | | Duration of therapy: 3-6 months<br><br>* For first 2-4 weeks only |
| *C. burnetii* (agent of Q fever) | Doxycycline 100mg PO q12h<br>**PLUS**<br>Hydroxychloroquine 600mg PO q24h or 200mg PO q8h | | Duration: 18-24 months based on clinical and serological response |
| *Bartonella spp.* | Doxycycline 100mg PO q12h for 6 weeks<br>**PLUS**<br>Gentamicin 3mg/kg IV q24h for 2 weeks | | |
| **Therapy for Culture-Negative Endocarditis - Consultation with an infectious disease specialist needed** | | | |

Footnotes for antibiotic treatment of endocarditis:

1. Vancomycin : aim for serum trough level of 15-20 mg/for both adults and pediatrics. Dose should be adjusted in patients with renal impairment.
2. For patients on gentamicin:
   - Monitor gentamicin level and renal function weekly. There should be a low threshold for stopping gentamicin in patients with deteriorating renal function or other signs of toxicity.
   - Aim for peak serum level of 3-5mcg/mL & pre-dose (trough) serum level of 1mcg/mL when 2-3 divided doses are given.
   - Consider biweekly clinical screening for ototoxicity: Check baseline visual acuity using a Snella pocket card, to screen for ototoxicity, have patient shake head and reread the card, consider formal audiology test if patient loses 2 lines of visual acuity.
   - For obese patients use ideal body weight
   - For high level gentamicin resistance, ampicillin/sulbactam or vancomycin continued for ≥ 6weeks, .Refer ID physician.
3. Rifampicin should be combined with another effective antistaphylococcal drug to minimize risk of resistance. Rifampicin increases hepatic clearance of warfarin & other drugs

**References:**


1. Clinical Practice Guidelines for the Prevention, Diagnosis and Management of Infective Endocarditis 2017, National Heart Association of Malaysia and the Academy of Medicine Malaysia
2. National Antibiotic Guideline 2019 - Cardiovascular Infections for Adults
3. Gilbert Habib et al. ESC Scientific Document Group, 2015 ESC Guidelines for the management of infective endocarditis: The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC)
   Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM), *European Heart Journal*, Volume 36, Issue 44, 21 November 2015

## CENTRAL NERVOUS INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Meningitis (acute): Empirical Therapy** | | | |
| **Common organisms:**<br>*Streptococcus pneumoniae*<br>*Haemophilus influenzae*<br>*Neisseria meningitidis*<br><br>**Other organisms:**<br>Gram-negative rods | Ceftriaxone 2g IV q12h<br>**OR**<br>Cefotaxime 2g IV q6h | **Alternative ONLY for immunocompromised host:**<br>Meropenem 2g IV q8h | Antibiotic should not be delayed if lumbar puncture (LP) is delayed by radiological investigation.<br><br>If no organism is isolated from CSF C&S but LP is suggestive of bacterial meningitis and patient is responding, continue antibiotics for 14 days<br><br>Dexamethasone 10mg IV q6h is recommended 15 to 20 minutes before or at the time of first dose of antibiotics. Continue for 4 days if the Gram stain and/or cultures consistent with *S. pneumoniae*. Discontinue if not *Streptococcus pneumonia* or if bacterial meningitis is subsequently thought not to be present.<br><br>Incidence of listeriosis increases in people > 60 years of age, immunosuppressed & pregnancy. Consider empirical cover for this organism especially if the course of disease is indolent or there is |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | epidemiological risk (refer section on treatment of listeriosis)<br><br>Duration: 10-14 days |
| **Meningitis (acute): Causative organism isolated** | | | |
| ***Haemophilus influenzae*** **(Gram-negative bacilli)** | Ceftriaxone 2g IV q12h<br>**OR**<br>Cefotaxime 2g IV q6h | Cefepime 2g IV q8h.<br><br>**If organism is susceptible and patient is allergic to cephalosporins:**<br>Ciprofloxacin 400mg IV q8h | Duration: 7-10 days |
| ***Streptococcus pneumoniae*** **(Gram-positive cocci)** | **Penicillin-sensitive strains (MIC to Penicillin < 0.12 mcg/mL)**<br>Benzylpenicillin 4MU IV q4h<br><br>**Penicillin-resistant strains (MIC to Penicillin ≥0.12 mcg/mL)**<br>Ceftriaxone 2g IV q12h<br>**OR**<br>Cefotaxime 2g IV q6h<br><br>**Cephalosporin-resistant strains (MIC to Cephalosporin ≥2 mcg/mL):**<br>Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose<br><br>**PLUS**<br>Ceftriaxone 2g IV q12h | **Penicillin-resistant strain (MIC to Penicillin ≥0.12 mcg/ml)**<br>Cefepime 2g IV q8h<br>**OR**<br>Meropenem 2g IV q8h | All attempts should be made to ascertain the MIC of isolated pneumococcus. Ceftriaxone or cefotaxime should be de-escalated to benzylpenicillin once the MIC result has been confirmed.<br><br>Duration: 10-14 days |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **OR**<br>Cefotaxime 2g IV q6h | | |
| ***Neisseria meningitidis*** **(Gram-negative diplococci)** | **If MIC to Penicillin < 0.1 mcg/mL**:<br>Benzylpenicillin 4MU IV q4h<br><br>**If MIC to penicillin is > 0.1 mcg/mL:**<br>Ceftriaxone 2g IV q12h<br>**OR**<br>Cefotaxime 2g IV q6h | | Duration: 5-7 days |
| **Prophylaxis for household and close contacts of *meningococcal* meningitis cases** | **Age > 15 years:**<br>*Ciprofloxacin 500mg PO as single dose<br>**OR**<br>*Rifampicin 600mg PO q12h for 2 days (4 doses) | Ceftriaxone 250mg IM as single dose (especially in pregnancy and lactating mothers)<br>**OR**<br>Azithromycin 500mg PO as single dose | Close contacts are defined as those individuals who have had contact for > 8 hours and within 1 metre of the index case. Individuals who were in contact with oropharyngeal secretions of the index case in the last 7 days before onset of symptoms up to 24 hours after appropriate antibiotics should also receive chemoprophylaxis.<br><br>For index cases who received only benzylpenicillin as therapy, chemoprophylaxis should also be given upon discharge to eliminate nasopharyngeal carriage.<br><br>*Not recommended in pregnant women |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Listeriosis** | Ampicillin 2g IV q4h<br>**OR**<br>Benzylpenicillin 4MU IV q4h<br><br>**PLUS/MINUS**<br>Gentamicin 5mg/kg/day IV in 3 divided doses | Trimethoprim/ sulfamethoxazole 10-20mg/kg/day [based on the TMP component] IV q6-12h<br>**OR**<br>Meropenem 2g IV q8h | Duration of treatment is 3 weeks depending on clinical response. May be longer in immunocompromised host.<br><br>Gentamicin is given until symptoms improve (minimum of 1 week) |
| **Brain abscess/subdural empyema: Empirical Therapy** | | | |
| **Common organisms:**<br>*Streptococcus*<br>*Staphylococcus*<br>Gram-negative bacilli<br>Anaerobes<br><br>**Source**:<br>1. Dental or Oral<br>2. Paranasal Sinus or Otogenic<br>3. Hematogenous spread or penetrating trauma (community acquired)<br><br>**Source:**<br>Hematogenous spread (hospital acquired) or post neurosurgical operation | Ceftriaxone 2g IV q12h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>Ceftriaxone 2g IV q12h<br><br>If patient has history of MRSA infections, consider adding:<br>Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose. | | Surgical intervention: excision or aspiration of the abscess is treatment of choice if the size of the abscess is more than 2.5cm<br><br>Blood cultures, WBC and CRP should be taken when a diagnosis of brain abscess is suspected.<br><br>Other screenings needed are ECHO (for patient with heart problem-to see possibilities of vegetation) and scope (for paranasal sinus) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Brain abscess/ subdural empyema: Causative organism isolated** | | | |
| *Streptococcus milleri* | Benzylpenicillin 4MU IV q6h | Cefotaxime 2g IV q6h<br>**OR**<br>Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose | Duration to be determined by clinical response (usually 4-8 weeks with IV therapy for 2 weeks minimum depending on whether surgical drainage done, clinical and radiological response).<br><br>*Vancomycin is inferior to cloxacillin or Cefazolin for the treatment of MSSA. Additionally, vancomycin has poor CNS penetration. Therefore it should be only considered as an alternative in the setting of penicillin allergy.<br><br>**Duration of Treatment**:<br>-3-4 weeks if abscess has been excised<br>-4-6 weeks if abscess has been aspirated<br>(Minimum of 4 weeks if abscess treated with antibiotic alone and CT showing resolution of ring enhancing lesions & good clinical progress)<br><br>Patient can be switched onto oral therapy when:<br>1. CRP falls to normal levels.<br>2. No signs of fever |
| *Staphylococcus aureus* (Methicillin-sensitive) | Cloxacillin 2g IV q4h<br>**OR**<br>Cefazolin 2g IV q8h | *Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose<br>**OR**<br><br>If no bacteremia:<br>Trimethoprim/sulfamethoxazole 10mg/kg/day [based on TMP component] IV q6-12h | |
| Enterobacterales | Cefotaxime 2g IV q6h | Meropenem 2g IV q8h | |
| *Pseudomonas aeruginosa* | Ceftazidime 2g IV q8h | Meropenem 2g IV q8h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | 3. Appropriate oral antibiotics are available<br>4. Patient can tolerate oral antibiotics |
| **Spinal Epidural abscess**<br><br>Common organisms:<br>*Streptococci*<br>*Staphylococcus*<br>Gram-negative bacilli | Cloxacillin 2g IV q4h<br>**OR**<br>*Vancomycin 25-30mg/kg loading dose<br>then 15mg/kg IV q8-12h; not to exceed 2g per dose<br><br>**PLUS**<br><br>Gentamicin 4-7mg/kg/day IV in 3 divided doses<br>**OR**<br>**Ceftriaxone 2g IV q12h<br>**OR**<br>**Cefotaxime 2g IV q4-6h | | Source control is strongly recommended.<br><br>Duration to be determined by clinical response (usually 2-6 weeks with IV therapy for 2 weeks minimum, followed by oral depending on whether surgical drainage done, clinical and radiological response).<br><br>*Vancomycin is indicated when suspecting MRSA or allergy to Cloxacillin<br><br>**Third-generation cephalosporin indicated when gentamicin is contraindicated. |
| **Viral encephalitis**<br><br>Common organisms:<br>Herpes simplex<br>Varicella zoster | *Acyclovir 10mg/kg IV q8h | | *Consider using ideal body weight in obese patients.<br><br>Duration: 14-21 days |
| **Meningitis (Chronic)** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Tuberculous meningitis**<br>*(Mycobacterium tuberculosis)* | **Intensive 2 months S/EHRZ and 10 months HR**<br><br>Isoniazid (H) 5 (4-6) mg/kg/day PO (max: 300 mg/day)<br>**PLUS**<br>Rifampicin (R) 10 (8-12) mg/kg/day PO (max: 600mg/day)<br>**PLUS**<br>Pyrazinamide (Z) 25 (20-30)mg/kg/day PO (max: 2000 mg/day)<br>**PLUS**<br><br>Streptomycin (S) 15 (12-18) mg/kg/day IM (max: 1000mg/day)<br>**OR**<br>Ethambutol (E) 15 (15-20)mg/kg/day PO (max: 1600mg/day)<br><br>Pyridoxine 10-50mg PO q24h needs to be prescribed together with Isoniazid | **In HIV patients:**<br>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.**<br><br>Daily dosing is recommended rather than intermittent dosing.<br><br>Rifampicin is not recommended in combination with all protease inhibitors (PIs) and rifabutin should be used with PI-based ART for HIV-TB co-infected adults. | **<u>Infection in HIV patients</u>**:<br>Add IV 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, prednisolone 30-40mg/day PO in tapering doses for 6 weeks.<br><br>Treatment is continued for 12 months.<br><br>Refer to Clinical Practice Guidelines on Management of Tuberculosis (4th edition). |
| **Cryptococcal meningitis**<br>*Cryptococcus neoformans*<br>(non-HIV, non-transplant patients) | **Induction Therapy**:<br>Amphotericin B 0.7-1.0mg/kg/day IV q24h<br>**PLUS**<br><br>5-Flucytosine 100mg/kg/day PO q6h<br>**OR**<br>Fluconazole 1200mg PO q24h. | **Induction Therapy**:<br>Fluconazole 1200mg PO q24h<br>**PLUS**<br>5-flucytosine 100mg/kg/day PO q6h | Lipid formulations of amphotericin may be used in cases of severe nephrotoxicity:<br><br>*The lipid formulations:<br>**Amphotericin B lipid complex**: 5mg/kg IV q24h<br>**Amphotericin B liposomal**: 3-4mg/kg IV q24h may be used. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | *Both lipid formulations require special medicine approval<br><br>Duration of **induction therapy**: 4-6 weeks |
| | **Consolidation Therapy**:<br>Fluconazole 400-800mg PO q24h | | Duration of **consolidation therapy**: 8 weeks |
| | **Maintenance Therapy:**<br>Fluconazole 200mg PO q24h | | Duration of **maintenance therapy**: up to 12 months |
| **Healthcare-associated ventriculitis and meningitis** | Empirical treatment should be decided by the primary team based on local antibiogram and CSF gram stain result. | | De-escalate antibiotics to targeted therapy when the culture results are available.<br><br>*Vancomycin trough level should be 15- 20mcg/L |
| | **If C&S is not available:**<br>Ceftazidime 2g IV q8h<br>**PLUS/MINUS**<br>*Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose | Meropenem 2g IV q8h<br>**PLUS/MINUS**<br>*Vancomycin 25-30mg/kg loading dose then 15-20mg/kg IV q8-12h; not to exceed 2g per dose | |
| **Cranial Trauma**<br>1. Open fracture &<br>2. Penetrating injuries | Amoxicillin/clavulanate 1.2g IV q8h | Cefuroxime 1.5g IV q8H<br>**PLUS**<br>Metronidazole 500mg IV q8H | Duration: 5-7 days |
| **Penetrating craniocerebral injuries** | Ceftriaxone 2g IV q12h<br>**PLUS**<br>Metronidazole 400mg PO q8h | | Duration: for 2 weeks initially and then review with microbiology |
| **Neurosyphilis** | Refer to section (Sexually Transmitted Infections) | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **HIV related CNS infection** | Refer to section (Infections in Immunocompromised Patients - Human Immunodeficiency Virus) | | |


**References:**

1. Brouwer MC et al. Corticosteroids for acute bacterial meningitis. Cochrane Database of Systematic Reviews 2015, Issue 9. Art. No.: CD004405
2. Pasquale Pagliano et al. Listeria monocytogenes meningitis in the elderly: epidemiological, clinical and therapeutic findings. Le Infezioni in Medicina, n. 2, 105-111, 2016
3. van de Beek, D. et al. ESCMID guideline: diagnosis and treatment of acute bacterial meningitis. Clinical Microbiology and Infection, Volume 22 , S37 - S62
4. McGill, F. et al. The UK joint specialist societies guideline on the diagnosis and management of acute meningitis and meningococcal sepsis in immunocompetent adults.Journal of Infection, Volume 7, Issue 4, 405 – 438.
5. Solomon, T. et al. Management of suspected viral encephalitis in adults – Association of British Neurologist and British Infection Association National Guidelines. Journal of Infection, Volume 64, Issue 4 , 347 – 373.
6. Allan R. Tunkel et al. 2017 Infectious Diseases Society of America's Clinical Practice Guidelines for Healthcare-Associated Ventriculitis and Meningitis, Clinical Infectious Diseases, Volume 64, Issue 6, 15 March 2017,
7. Peter R. Williamson et al. Cryptococcal meningitis: epidemiology, immunology, diagnosis and therapy. Nature Reviews Neurology Volume 13, pages 13–24 (2017)
8. The Sanford Guide to Antimicrobial Therapy 2018.
9. Antibiotic Expert Groups. Therapeutic guidelines: antibiotics. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014.
10. R Bayston, J de Louvois, E M Brown, R A Johnston, P Lees, I K People, "Infection in Neurosurgery '' Working Party of British Society for Antimicrobial Chemotherapy. Lancet 2000; 355: 1813–17
11. Chaudhuri A. et al. EFNS guideline on the management of community-acquired bacterial meningitis: report of an EFNS Task Force on acute bacterial meningitis in older children and adults. European Journal of Neurology 2008, 15: 649–659
12. Allan R. Tunkel et al. Practice Guidelines for the Management of Bacterial Meningitis Clinical Infectious Diseases 2004; 39:1267–84
13. Clinical Practice Guidelines on Management of Tuberculosis (3rd edition) MOH/P/PAK/258.12(GU).
14. Clinical Practice Guidelines for the management of cryptococcal disease:2010 update by IDSA.
15. Guideline for Management of Brain Abscess and Subdural Empyema, Leeds Teaching Hospitals NHS Trust 2022 (website: http://www.lhp.leedsth.nhs.uk/detail.aspx?id=1431)- last review 3/1/22 .

## GASTROINTESTINAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Oropharyngeal Candidiasis** | | | |
| Oral Thrush | Refer to section (Infections in Immunocompromised Patients - HIV) | | |
| **Esophagitis** | | | |
| Candida | Refer to section (Infections in Immunocompromised Patients - HIV) | | |
| Herpes simplex virus | Refer to section (Sexually Transmitted Infections) | | |
| Cytomegalovirus | Refer to section (Infections in Immunocompromised Patients - HIV) | | |
| ***Helicobacter pylori* Infection** | | | |
| | **First line treatment***<br>**Triple Therapy:**<br>Proton Pump Inhibitors PO q12h<br>**PLUS**<br>Amoxicillin 1g PO 12h<br>**PLUS**<br><br>Clarithromycin 500mg PO q12h<br>**OR**<br>Metronidazole 400mg PO q12h<br><br>**Second Line Treatment**[1]<br>Fluoroquinolone triple therapy:<br>Proton Pump Inhibitors PO q12h<br>**PLUS** | **Antibiotic allergy:**<br>Proton Pump Inhibitors PO q12h<br>**PLUS**<br>Clarithromycin 500mg PO q12h<br>**PLUS**<br>Metronidazole 400mg PO q12h | Dosages of Proton Pump Inhibitors:<br>-Pantoprazole 40mg PO q12h<br>-Esomeprazole 40mg PO q12h<br><br>*First line treatment recommended in areas with < 15-20% of Clarithromycin resistance<br><br>Duration of therapy = 14 days<br>-Meta analysis of RCTs found 14 days duration of therapy showed greater eradication rate |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Levofloxacin 500mg PO q24h<br>**PLUS**<br><br>Amoxicillin 1g PO q12h<br>**OR**<br>Metronidazole 400mg PO q12h | | |


**References :**
1. Malfertheiner P et al.Management of Helicobacter pylori infection--the Maastricht IV/ Florence Consensus Report .Gut 2012;61: 646 – 64.
2. V. Mahachaiet al., "H. Pylori management in ASEAN: the Bangkok consensus report," Journal of Gastroenterology and Hepatology, vol. 33, no. 1, pp. 37– 56, 2017
3. Chey WD et al. ACG clinical guideline: Treatment of Helicobacter pylori infection. Am J Gastroenterol 2017 Jan10.


**Infectious Diarrhoea**

Most community-acquired diarrhoea is viral in origin (norovirus, rotavirus, and adenovirus), antibiotic therapy does not shorten the duration of symptoms, therefore should be discouraged.

When to consider empirical treatment for acute diarrhoea?
- Immunocompetent host with high grade or persistent fever, or with dysentery or in sepsis
- Immunocompromised host
- Suspected enteric fever

| | | | |
|---|---|---|---|
| Empirical treatment | Ciprofloxacin 500mg PO q12h<br>**OR**<br>Azithromycin 500mg PO q24h | | Duration: 3 days |
| Non-Shiga toxin producing *E.coli* (STEC),<br>*Aeromonas/ Plesiomonas*<br>*Yersinia species* | Trimethoprim/sulfamethoxazole 160/800mg PO q12h | Ciprofloxacin 500mg PO q12h | Duration: 3 days |
| *Campylobacter jejuni* | Azithromycin 500mg PO q24h | | Duration: 3 days |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | In immunocompromised: consider longer duration of therapy |
| *Salmonella*, non-typhi | Trimethoprim/sulfamethoxazole 160/800mg PO q12h | Ciprofloxacin 500mg PO q12h<br>**OR**<br>Azithromycin 500mg PO q24h<br>**OR**<br>Ceftriaxone 2gm IV q24h | Duration :<br>Immunocompetent: 5-7 days<br>Immunocompromised: 14 days<br><br>Antibiotic is usually not indicated, except in patient<br>• < 6 months old or >50 years old<br>• with severe illness or in septic shock<br>• with prostheses, valvular heart disease or severe atherosclerosis<br>• with malignancy<br>• who is immunocompromised |
| *Salmonella, non-typhi*<br>- in HIV patients | Refer to section (Infections in Immunocompromised Patients - HIV) | | |
| *Salmonella enterica serovar Typhi* and *Paratyphi* (Typhoid Fever) | Refer to section (Tropical Infections) | | |
| *Vibrio cholera* | Primary therapy is rehydration<br><br>Azithromycin 1g PO single dose<br>**OR**<br>Doxycycline 300mg PO single dose | Erythromycin Ethylsuccinate 800mg PO q12h for 3 days | Antibiotic is to reduce the shedding time |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| *Shigella* sp.<br>(Fever and bloody stool) | Ciprofloxacin 750mg PO q12h for 3 days | Azithromycin 500mg PO q24h for 3 days<br>**OR**<br>Trimethoprim/sulfamethoxazole 160/800mg PO q12h for 3 days<br><br>**For severe disease:**<br>Ceftriaxone 2gm IV q24h for 2-5 days | In immunocompromised patients, duration of antibiotic is 7-10 days. |
| *Giardiasis* | Metronidazole 400mg PO q8h | | Duration : 7-10 days |
| *Entamoeba histolytica* | Metronidazole 800mg PO q8h for 5–10 days<br>**PLUS**<br>*Paromomycin 500mg PO q8h for 7 days | | *Requires special medicine approval |
| ***Clostridium difficile* Infection (CDI)**<br>- Discontinue therapy with inciting antibiotic agent as soon as possible as may influence risk of CDI recurrence | | | |
| Initial (Non severe) | Vancomycin 125mg PO q6h | Metronidazole 400mg PO q8h | Duration : 10 days |
| Initial (Severe) | Vancomycin 125mg PO q6h | Metronidazole 500mg IV q8h<br>**PLUS**<br>Vancomycin 125mg PO q6h | Duration : 10 days<br><br>Symptoms to indicate severe colitis:<br>-WCC >15 x $10^9$<br>-Creatinine 50% increase from baseline<br>- Temperature > 38.5°C<br>- Evidence of severe colitis (abdominal signs; radiography) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| Initial (Fulminant/ Severe with Complications) | *Vancomycin 500mg PO q6h<br>**PLUS**<br>Metronidazole 500mg IV q8h | | Duration: 10 days<br><br>*If ileus, consider rectal instillation of Vancomycin (enema): Vancomycin 500mg (in 100 mL normal saline) q6h via enemas or by nasogastric tube |
| Recurrent | **If vancomycin was used for the first episode:**<br>Vancomycin pulsed-tapered regimen<br>125mg PO q6h for 10-14 days then<br>125mg PO q12h for 7 days then<br>125mg PO q24 for 7 days then<br>125mg PO q48-72h for 2-8 weeks | **If metronidazole is used for the first episode:**<br>Vancomycin 125mg PO q6h for 10- 14 days | Duration: 10 - 14 days |

**References:**


1. Riddle et al. ACG clinical guideline: diagnosis, treatment, and prevention of acute diarrheal infections in adults. Am J Gastroenterol. 2016;111:602–622
2. Shane et al. 2017 IDSA CPG for the Diagnosis and Management of Infectious Diarrhea.CID 2017:65.
3. McDonald et al. Clinical Practice Guidelines for Clostridium difficile Infection in Adults and Children: 2017 Update by IDSA and Society for Healthcare Epidemiology of America (SHEA).Clin Infect Dis.Feb 15,2018. doi:10.1093/cid/cix1085
4. UK: https://www.guidelines.co.uk/infection/phe-infectious-diarrhoea-guideline/252651.article
5. AUS: https://www.ncbi.nlm.nih.gov/pubmed/27062204


| **Traveller's Diarrhea** | | | |
|---|---|---|---|
| **Mild Diarrhoea**<br>-Diarrhoea that is tolerable, not distressing | Antibiotic is not indicated | | |
| **Moderate Diarrhoea** | Azithromycin 1g PO single dose or 500mg PO q24h | Ciprofloxacin 750mg PO stat or 500mg PO q12h | Antibiotic therapy may be considered<br>Duration : 3 days |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| -Diarrhoea that is distressing or interferes with planned activities<br><br>**Severe Diarrhoea**<br>-Diarrhoea that incapacitating or completely prevents planned activities; including all dysentery | Azithromycin 1g PO single dose or 500mg PO q24h | Ciprofloxacin 750mg PO stat or 500mg PO q12h | Antibiotic therapy may be considered<br>Duration : 3 days |
| **References :**<br>1. Riddle et al. Guidelines for the prevention and treatment of travellers' diarrhoea: a graded expert panel report. J Travel Med 2017; 24:S7<br>2. https://www.racgp.org.au/afp/2015/januaryfebruary/advising-travellers-about-management-of-travellers%E2%80%99-diarrhoea/ (aus) | | | |
| **Liver Abscess** | | | |
| Pyogenic liver abscess<br>*Klebsiella spp.,*<br>*Escherichia coli* | **Empirical therapy**<br>Ceftriaxone 2g IV q24h<br>**OR**<br>Cefotaxime 2g IV q8h<br><br>**PLUS/MINUS**<br>*Metronidazole 500mg IV q8h | Amoxicillin/clavulanate 1.2g IV q6-8h | Duration : 4-6 weeks<br>To consider drainage if abscess size is ≥5cm or impending rupture.<br><br>*Metronidazole: Risk factors of anaerobic liver abscess:<br>• acute and chronic inflammatory bowel disease with or without perforation<br>• malignancy of gastrointestinal tract<br>• surgery of the gastrointestinal<br>• tract or pelvic organs<br><br>Metronidazole has excellent |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | bioavailability: consider IV to PO switch |
| Amoebic liver abscess<br>*Entamoeba histolytica* | **Amoebicidal agent:**<br>*Metronidazole 750mg IV q8h for 10 days followed by<br>**Luminal agent:**<br>-To eradicate intestinal colonisation after Amoebicidal treatment<br>**Paromomycin 25-35mg/kg/day PO q8h for 7 days | | *May switch to PO Metronidazole 800mg q8h when there is satisfactory clinical improvement.<br><br>Drainage of amoebic liver abscess is not usually required but is necessary if :<br>1. The patient does not respond to antibiotic therapy<br>2. The abscess is >5 cm in diameter<br>3. The abscess is in the left lobe of the liver<br>4. The diagnosis remains in doubt<br><br>**Requires special medicine approval. |
| **References :**<br>1. Anesi,J and Gluckman S.Amebic Liver Abscess Clinical Liver Disease, Vol 6, No 2, August 2015<br>2. Stanley et al. Amoebiasis, Lancet 2003; 361: 1025–34<br>3. Hope et. Optimal treatment of hepatic abscess. Am Surg. 2008;74:178-182 | | | |
| **Cholecystitis and Cholangitis** | | | |
| Community-acquired:<br>-*Enterobacterales* (>50%)[1]<br>-Bacteroides only comprise 4-20% of biliary infection. | Amoxicillin/clavulanate 1.2g IV q8h | 3rd gen. cephalosporins:<br>Cefoperazone 1-2g IV q12h<br>**OR**<br>Cefotaxime 2g IV q8h | Duration: 4-7 days<br><br>Appropriate source control to drain infected foci and restoration of |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | **PLUS/MINUS**<br>Metronidazole 500mg IV q8h<br>(if biliary enteric anastomosis is present) | anatomic and physiological function is recommended for all patients, as antibiotics will not enter bile in the presence of obstruction. |
| Hospital-acquired | *Piperacillin/tazobactam 4.5g IV q6-8h | | * Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |

**Reference s:**

1. Gomi,H. et al. Tokyo Guidelines 2018: antimicrobial therapy for acute cholangitis and cholecystitis. J Hepatobiliary Pancreat Sci, 25: 3–16. doi:10.1002/jhbp.518
2. Joseph et al, 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 , CID 2010; 50:133–64

**Spontaneous bacterial peritonitis (SBP)**

| | | | |
|---|---|---|---|
| Primary SBP<br>Enterobacterales *(eg. E. coli K. pneumoniae, Streptococcus sp.)* | Cefotaxime 2g IV q8h<br>**OR**<br>Ceftriaxone 1g IV q12h | Amoxicillin/clavulanate 1.2g IV q8h | Duration : 5 days |
| In cirrhotic with upper gastrointestinal haemorrhage | Ceftriaxone 1g IV q12h<br>**OR**<br>Cefotaxime 2g IV q8h | *IV Ciprofloxacin 400mg IV q12h | Duration : 7 days<br><br>*Ciprofloxacin does not penetrate into ascitic fluid to the same extent as cefotaxime |

**References :**

1. Bhuva et al. Spontaneous bacterial peritonitis: An update on evaluation, management, and prevention Am J Med 1994;97:169–175.
2. Rimola et al. Diagnosis, treatment and prophylaxis of spontaneous bacterial peritonitis: a consensus document. Journal of Hepatology 2000; 32: 142-153
3. Rimola A, Salmerón JM, Clemente G, Rodrigo L, Obrador A, Miranda ML,et al. Two different dosages of cefotaxime in the treatment of spontaneous bacterial peritonitis in cirrhosis: results of a prospective, randomised,multicenter study. Hepatology 1995;21:674–679.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |

4. Navasa M, Follo A, Llovet JM, Clemente G, Vargas V, Rimola A, et al. Randomised, comparative study of oral ofloxacin versus intravenous cefotaxime in spontaneous bacterial peritonitis.Gastroenterology 1996;111:1011–1017.
5. Sort P, Navasa M, Arroyo V, Aldeguer X, Planas R, Ruiz delArbol L, et al. Effect of intravenous albumin on renal impairment and mortality in patients with cirrhosis and spontaneous bacterial peritonitis. N Engl J Med 1999;341:403–409.
6. Ricart E, Soriano G, Novella MT, Ortiz J, Sàbat M, Kolle L, et al. Amoxicillin– clavulanic acid versus cefotaxime in the therapy of bacterial infections in cirrhotic patients. J Hepatol 2000;32:596–602.
7. UK: https://gut.bmj.com/content/55/suppl_6/vi1
8. Terg R, et al. Oral ciprofloxacin after a short course of intravenous ciprofloxacin in the treatment of spontaneous bacterial peritonitis: results of a multicenter, randomised study. *J Hepatol*. 2000;33(4):564-569

# INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

## A. HAEMATOLOGY/ONCOLOGY

**1.** Any infection in the immune-compromised host is life-threatening and needs immediate attention.

**2.** Febrile neutropenia is defined as a temperature >38.3$^0$C on a single occasion or >38$^0$C over one hour and ANC (Absolute Neutrophil Count) <500 cells/uL or <1000 cells/uL in those with anticipated declining counts.

**3.** Cultures may be positive in < 40% of cases. Patients have impaired inflammatory responses and hence may have no localising signs. The usual sign is fever >38$^0$C or hypothermia.

**4.** The common portals of infection include the oral cavity, gastrointestinal tract, perianal region, lungs and IV lines. Potential pathogens are dependent on the underlying defect, e.g.

| | |
|---|---|
| Neutropenia | Gram-positive organisms, Gram-negative organisms, Fungi |
| Hypogammaglobulinemia; Post splenectomy or hyposplenic patients | Encapsulated organisms |
| Defective cellular immunity | Pneumocystis, Toxoplasma, Fungi, Viruses, Mycobacteria |

**5.** The choice of antibiotic is based on local organisms and sensitivity patterns, sound clinical judgement, the clinical state of the patient, prior infections with drug-resistant bacteria, recent outbreaks (e.g. MRSA or multidrug resistant *Enterobacterales*) as well as the availability and cost of the antibiotics.

**6.** Surveillance for **CRE, *Stenotrophomonas maltophilia* and multi-resistant organisms** should be carried out by the infection control team. The incidence of these organisms must be borne in mind when selecting agents for use in the first line setting.

**7.** Validated risk assessment scoring systems included the Multinational Association for Supportive Care in Cancer (MASCC) score and the Clinical Index of Stable Febrile Neutropenia (CISNE) score should be used for the classification of low or high risk group of patients

8. **LOW RISK PATIENTS**

The use of **oral antibiotics** with **Amoxicillin/clavulanate 625mg q8h (Clindamycin 600mg q6h if penicillin allergic**) **PLUS/MINUS Ciprofloxacin 500mg q12h** (if previously colonised by *Pseudomonas aeruginosa* and patient not on prior fluoroquinolone prophylaxis) may be considered after careful assessment of risk factors and a consult from the hematologist.(i.e no evidence of dehydration or hypotension, no pneumonia/COAD). Besides, it is important that patients must be able to access prompt medical attention if their condition deteriorates.

9. **HIGH RISK PATIENTS**

Risk assessment for complications of severe infection should be done during triage. Patient should be admitted to hospital for **IV antibiotics** if deemed **high risk** with the presence of:

a) prolonged (> 7 days) and profound ANC < $0.1 \times 10^9$/L,
b) hypotension
c) pneumonia
d) new onset abdominal pain or neurological signs
e) MASCC <21 or CISNE ≥ 3 at the time of assessment

10. The administration of the first dose of empirical antipseudomonal antibiotic should be done as soon as possible following triage (within the 1st hour) after taking blood cultures. The following regimens are suggested: Empirical antibiotics should be continued until ANC > $0.5 \times 10^9$/L and the patient is clinically stable and afebrile.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Febrile Neutropenia** | | | |
| ***Pseudomonas aeruginosa*** | **First line**<br>Piperacillin/tazobactam 4.5g IV q6h<br>**OR**<br>Cefepime 2g IV q8h<br><br>**PLUS/MINUS**<br>*Gentamicin 5mg/kg IV q24h<br>**OR**<br>Amikacin 15mg/kg q24h<br><br>**Second line** | **Ceftazidime 2g IV q8h | Duration: until neutrophils count >500 cells/uL or longer if clinically indicated (> $1 \times 10^9$/L)<br><br>*Monotherapy (Piperacillin/tazobactam, cefepime, imipenem or meropenem) is likely as efficacious and less toxic. Aminoglycosides may be added in patients with severe sepsis for broader Gram-negative coverage. It |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **After 3 days, no improvement or condition worsening (severe sepsis or impending shock):**<br>Meropenem 1g IV q8h (2g IV q8h if suspected central nervous system infection)<br>**OR**<br>Imipenem 500mg IV q6h (1g q8h if severe sepsis**)** | | can be discontinued if microbiological cultures showed isolated organisms sensitive to piperacillin/tazobactam or cefepime and the patient is clinically stable.<br><br>**Weak Gram-positive coverage and increased breakthrough infections limit utility<br><br>Carbapenem **NOT** commonly recommended as 1st line unless<br>- severe sepsis<br>- patients with previous infections of ESBL organisms or gram-negative organisms resistant to narrow spectrum B-lactams |
| **Anaerobes** | **PLUS**<br>Metronidazole 500mg IV q8h | | Metronidazole may be added to cefepime in the presence of<br>1) severe mucositis<br>2) intra-abdominal infections<br>3) peri-anal abscesses or<br>4) pseudomembranous colitis<br><br>Piperacillin/tazobactam and carbapenems have good anaerobic coverage and therefore do not need addition of metronidazole. |
| **MRSA** | **PLUS** | **VRE/VISA/VRSA:** | Empirical used of vancomycin if: |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Vancomycin 15mg/kg IV q8-12h | **Linezolid 600mg PO/IV q12h | a. Known colonisers by MRSA not responding to adequate empirical antibiotics<br>b. Suspected catheter-related infections<br>c. Suspected/ proven skin and soft tissue gram positive infections<br>d. Positive blood culture for gram positive bacteria/ proven methicillin-resistant gram-positive infections<br>e. Severe mucositis<br>f. Severe sepsis, septic shock or respiratory distress<br><br>To stop after 48 hours if there is no evidence of Gram-positive infection.<br><br>**To change to Linezolid if MRSA/MRSE not responding to or intolerant to Vancomycin and in those with suspected or confirmed VRE, VISA or VRSA. |

**11. Fungal infection**

Invasive fungal infection (IFI) is one of the most important infectious complications seen in patients with hematological malignancies and haematopoietic stem cell transplant (HSCT) recipients. *Aspergillus* species remain the most common pathogen followed by *Candida* species. The main risk factors for IFI are patients with underlying hematological malignancies, profound neutropenia, following a myelosuppressive chemotherapy, allogeneic HSCT and graft versus host disease.

Suspect fungal infection when there is:

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| a) mucositis, thrush<br>b) difficulty or pain when swallowing<br>c) suspicious skin lesions or pulmonary infiltrates<br>d) fundal exudates<br>e) persisted fever not responding to antibiotics (4 - 7 days)<br>f) prolonged steroid/ antibiotic usage (>2 week) | | | |
| **Invasive fungal infection** | Micafungin 100-150mg IV q24h<br>**OR**<br>Caspofungin 70mg IV loading, then 50 mg IV q24h<br>**OR**<br>Anidulafungin 200mg IV loading, then 100mg IV q24h | Voriconazole 6mg/kg q12h for 2 doses, then 4mg/kg q12h<br>**OR**<br>Amphotericin B deoxycholate 0.7 - 1mg/kg IV q24h | Azoles should not be used for empirical therapy in patients who have received an azole for prophylaxis. |
| **Invasive Aspergillosis** | Voriconazole 6 mg/kg q12h for 2 doses, then 4mg/kg q12h | Amphotericin B deoxycholate 0.7 -1mg/kg IV q24h<br>**OR**<br>IV Micafungin 150mg od<br>**OR**<br>Anidulafungin 200mg IV loading, then 100mg IV q24h<br>**OR**<br>Caspofungin 70mg IV loading, then 50 mg IV q24h | |
| **Candidaemia** | Micafungin 100-150mg IV q24h<br>**OR**<br>Anidulafungin 200mg IV loading, then 100mg IV q24h<br>**OR** | *Fluconazole 800 mg [12 mg/kg] stat, then 400 mg [6 mg/kg] q24h)<br><br>**Voriconazole: 400 mg (6 mg/kg) q12h for 2 doses, then 200 mg (3 mg/ kg) q12h | *For patients who are less critically ill and who have no recent azole exposure. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | Caspofungin 70mg IV loading, then 50 mg IV q24h | | **Can be used in situations in which additional mould coverage is desired.<br><br>Recommended duration of therapy for candidemia without persistent fungemia or metastatic complications is 2 weeks after documented clearance of Candida from the bloodstream and resolution of symptoms attributable to candidemia and resolution of neutropenia. |

**12. The use of prophylactic growth factors** (e.g.G-CSF)

i) Significantly reduced the relative risk for severe neutropenia, febrile neutropenia and infection and should be considered in high-risk patients with ANC < 100/Ul, multiple organ dysfunction syndrome, pneumonia, invasive fungal infections, septic shock or patients with reduced bone marrow reserve due to extensive radiotherapy.

ii) However, there is no evidence that either G-CSF reduced the number of patients requiring intravenous antibiotics or lowered infection related mortality.

iii) The role of granulocytes remains controversial and should be discussed with haematologists.

iv) 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.

**References:**


1. NCCN Clinical Practice Guidelines in Oncology. Prevention and Treatment of Cancer-Related Infections, version 2. 2017. National Cancer Comprehensive Network website. www.nccn.org/professionals/physician_gls/PDF/infections.pdf. Published February 21, 2017. Accessed September 27, 2017.
2. Hughes W T, Armstrong D, Bodey G P et al. 2002 Guidelines for the use of antimicrobial agents in neutropenic patients with cancer.Clinical Infectious disease 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 neutropenia. 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

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


6. 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 randomised 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 randomised 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; 44:471-4
14. NCCN Clinical Practice Guidelines in Oncology. Myeloid Growth Factors, version 1.2022. National Cancer Comprehensive Network website. www.nccn.org/professionals/physician_gls/PDF/myeloid_growth.pdf. Published April 28, 2017. Accessed May 22, 2022.
15. Taplitz RA, Kennedy EB, Bow EJ, Crews J, Gleason C, Hawley DK, Langston AA, Nastoupil LJ, Rajotte M, Rolston K, Strasfeld L. Outpatient management of fever and neutropenia in adults treated for malignancy: American Society of Clinical Oncology and Infectious Diseases Society of America Clinical Practice Guideline Update. J Clin Oncol. 2018 May 10;36(14):1443-53.
16. Zimmer AJ, Freifeld AG. Optimal management of neutropenic fever in patients with cancer. Journal of oncology practice. 2019 Jan ;15(1):19-24.
17. Klastersky J, De Naurois J, Rolston K, Rapoport B, Maschmeyer G, Aapro M, Herrstedt J. Management of febrile neutropenia: ESMO clinical practice guidelines. Annals of Oncology. 2016 Sep 1;27:v111-8.
18. Claeys KC, Zasowski EJ et al. Improves Outcomes Regardless of Vancomycin MIC in a Propensity-Matched Analysis of Methicillin-Resistant staphylococcus aureus Bloodstream Infections. Antimicrob Agents Chemother. 2016;60(10):5841.

## B. HUMAN IMMUNODEFICIENCY VIRUS (HIV)

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| ***Pneumocystis jiroveci (carinii)* interstitial pneumonia (PJP/PCP)** | | | |
| **Treatment** | Trimethoprim/sulfamethoxazole<br>15-20mg/kg/day [TMP component]/<br>IV/PO (excellent bioavailability)<br>in 3-4 divided doses | Primaquine 30mg (base) PO q24h<br>**PLUS**<br>Clindamycin 600mg IV q6h or 900mg q8h<br><br>**OR**<br>*Pentamidine 4mg/kg/day IV (in 1 pint D5% or NS run over<br>1-2 hours) | Duration: 21 days<br><br>Patients with severe disease (PO2 < 70mmHg at room air) should receive steroids as soon as possible<br>(Within 72 hours of starting PCP treatment):<br>Prednisolone* dose:<br>40mg PO q12h for 5 days then<br>40mg PO q24h for 5 days then<br>20mg PO q24h for 11 days<br><br>IV hydrocortisone or methylprednisolone at equivalent dose to prednisolone can be substituted for oral prednisolone.<br><br>Patients should be screened for G6PD deficiency before dapsone or primaquine is administered.<br><br>TMP/SMX PO has excellent bioavailability and should be preferred for patients who can tolerate orally without concerns over drug absorption. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Rates of adverse reaction to TMP-SMX are high. However, supportive care for non-life-threatening adverse effects should be attempted before the drug is discontinued. Lower doses of TMP-SMX may also be effective, potentially with lower toxicity.<br><br>*Requires special medicine approval |
| **Prophylaxis**<br>**(primary and secondary)**<br><br>*Indications:*<br>• CD4 count <200 cells/$mm^3$ or percentage less than 14%.<br>• Evidence of AIDS-defining illness, eg. oropharyngeal candidiasis, pulmonary TB etc.<br>• CD4 count 200-250 and if CD4 monitoring (e.g., every 3 months**)** is not possible or ART cannot be initiated | Trimethoprim/sulfamethoxazole 80/400mg 1 - 2 tablets PO q24h | Dapsone 100mg PO q24h<br>**OR**<br>*Aerosolized Pentamidine 300mg monthly (recommended to be delivered via Respigard II nebulizer) | Patients with CD4<100 cells/µL should receive at least 2 tablets of TMP/SMX daily to extend prophylaxis against toxoplasmosis.<br><br>Prophylactic regimens other than TMP/SMX should only be considered if TMP/SMX is absolutely contraindicated.<br><br>Aerosolized pentamidine or dapsone alone (without pyrimethamine) cannot prevent toxoplasmosis, hence they may not be suitable for patients who are at high risk of toxoplasmosis infection (seropositive toxoplasma IgG +ve and CD4<100 cells/µL)<br><br>*Requires special medicine approval |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | **Discontinuation of prophylaxis**:<br>Consider in patients with CD4>200 cells/µL and undetectable HIV viral load in response to successful ART.<br><br>**Restarting prophylaxis:**<br>CD4 count falls to <200 cells/µL<br>**OR**<br>PCP recurred at a CD4 count >200 cells/µL (lifelong prophylaxis should be considered) |
| **Mucocutaneous Candidiasis** | | | |
| **Oropharyngeal**<br>(oral thrush) | Fluconazole 100mg PO q24h | Nystatin suspension 500,000 units PO q6h<br>**OR**<br>Itraconazole oral solution 200mg PO q24h | Duration: 7-14 days<br><br>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 200mg PO/IV q24h for 14 days | Itraconazole oral solution 200mg PO q24h<br>**OR**<br>Voriconazole 200mg PO/IV q12h<br>**OR**<br>Echinocandins (anidulafungin, caspofungin or micafungin)<br>**OR** | Candidiasis is the most common cause of esophagitis with HIV infection, but CMV, HSV and aphthous ulcerations can present with similar complaints. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | Amphotericin B deoxycholate 0.6mg/kg IV q24h | Endoscopy required with unusual presentations or lack of response to azole within several days. |
| **Vulvovaginal** | Refer to section (Obstetrics & Gynaecology Infections) | | |
| **Cryptococcal meningitis or meningoencephalitis (*Cryptococcus neoformans*)** | | | |
| **Induction Therapy**<br>(for at least 2 weeks) | *If liposomal amphotericin B is not available:*<br><br>Amphotericin B deoxycholate 0.7-1mg/kg IV q24h<br>**PLUS**<br>Flucytosine 25mg/kg PO q6h for 7 days, followed by Fluconazole 1200mg PO q24h for 7 days<br><br>**OR**<br><br>*If liposomal amphotericin B is available:*<br><br>Liposomal Amphotericin B 10mg/kg IV (single dose)<br>**PLUS**<br>14 days of:<br>Flucytosine 25mg/kg PO q6h<br>**PLUS**<br>Fluconazole 1200mg PO q24h | *If flucytosine is not available:*<br><br>Amphotericin B deoxycholate 0.7-1mg/kg IV q24h<br>**PLUS**<br>Fluconazole 1200mg PO q24h<br><br>**OR**<br><br>Liposomal Amphotericin B 3-4mg/kg IV q24h<br>**PLUS**<br>Fluconazole 1200mg PO q24h<br><br>*If no amphotericin B formulations are available:*<br><br>Fluconazole 1200mg PO q24h<br>**PLUS**<br>Flucytosine 25mg/kg POq6h | Test dose of Amphotericin B is not required.<br><br>Ensure adequate hydration (e.g. 2 pints of IVD NS before and after administration of Amphotericin B) to prevent nephrotoxicity.<br><br>Pre-medication may be given before the administration of Amphotericin B (Promethazine 25mg IV and Paracetamol 1g PO/ Hydrocortisone 50mg IV).<br><br>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** | Fluconazole 800mg PO q24h | Itraconazole 200mg PO q12h | Duration: For 8 weeks |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Maintenance Therapy (Secondary prophylaxis)** | Fluconazole 200mg PO q24h | Itraconazole 200mg PO q24h | **Discontinuation:**<br>Consider in patients with CD4>200 cells/µL and undetectable HIV viral load in response to successful ART. |
| ***Toxoplasma gondii* Encephalitis** | | | |
| **Acute Infection**<br>(up to 97% patients are Toxo IgG +ve)<br><br>Induction therapy (for at least 6 weeks) | Trimethoprim/sulfamethoxazole 10mg/kg/day (TMP component) PO/IV in 2 divided doses | *Pyrimethamine 200mg PO loading dose followed by<br>- 50mg q24h (BW≤60kg)<br>- 75mgq24h (if BW>60kg)<br><br>**PLUS**<br>Folinic acid 10-25mg PO q24h<br>**PLUS**<br>Clindamycin 600mg IV/PO q6h | **Adjunctive corticosteroids** (e.g., dexamethasone) should be administered when clinically indicated to treat mass effect associated with focal lesions and perilesional edema. Because of the potential immunosuppressive effects, corticosteroids should be tapered down and discontinued as soon as clinically feasible.<br><br>Sulfadoxine/pyrimethamine 500mg/25mg (Fansidar®) can be used if pyrimethamine is not available. However, sulfadoxine/pyrimethamine is associated with higher incidence of adverse drug reactions such as sulfa allergy.<br><br>*Requires special medicine approval |
| **Suppressive/Maintenance Therapy** | Trimethoprim/sulfamethoxazole (80/400mg) 2 tablets PO q12h | *Pyrimethamine 25-50mg PO q24h | **Discontinuation of secondary prophylaxis**: |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | **PLUS**<br>Folinic acid 10-25mg PO q24h<br>**PLUS**<br>Clindamycin 600mg PO q8h | Consider in patients with CD4>200 cells/µL and undetectable HIV viral load in response to successful ART.<br><br>*Requires special medicine approval |
| **Primary Prophylaxis**<br>Indications:<br>ToxoIgG +ve with CD4<100 | Trimethoprim/sulfamethoxazole (80/400mg) 2 tabs PO q24h | Dapsone 50mg PO q24h<br>**PLUS**<br>*Pyrimethamine 50mg PO once weekly<br>**PLUS**<br>Folinic acid 10-25mg PO once weekly<br><br>**OR**<br><br>Dapsone 200mg PO weekly<br>P**LUS**<br>*Pyrimethamine 75mg PO once weekly<br>**PLUS**<br>Folinic Acid 25mg PO once weekly | The recommended regimens for primary prophylaxis of toxoplasmosis are also effective in preventing PCP.<br><br>**Discontinuation of primary prophylaxis**:<br>Consider in patients with CD4>100 cells/µL and undetectable HIV viral load in response to successful ART.<br><br>If CD4>100 cells/µL but <200 cells/µL, patients need to be maintained on PCP prophylaxis with TMP-SMX 80/400mg 1 tablet PO q24hr or dapsone 100mg PO q24hr.<br><br>*Requires special medicine approval |
| ***Mycobacterium avium* Complex (MAC) Disease** | | | |
| **Treatment** | (At Least 2 Drugs as Initial Therapy)<br><br>Clarithromycin 500mg PO q12h<br>**PLUS** | Azithromycin 500mg PO q24h<br>**PLUS**<br>Ethambutol 15mg/kg PO q24h<br><br>***PLUS** | ***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 ART. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Ethambutol 15mg/kg PO q24h<br><br>***PLUS**<br><br>3rd or 4th drug:<br>Amikacin 10-15mg/kg IV q24h<br>**OR**<br>Streptomycin 1g IM q24h<br><br>**OR**<br>Levofloxacin 500mg PO q24h | 3rd or 4th drug:<br>Amikacin 10-15mg/kg IV q24h<br>**OR**<br>Streptomycin 1g IM q24h<br><br>**OR**<br>Levofloxacin 500mg PO q24h | **Discontinuation:**<br>Consider if patient is on ART and viral load well suppressed, CD4 > 100 cells/µL for ≥6 months, asymptomatic of MAC, and has completed > 12 months of therapy. |
| **Maintenance/ Secondary Prophylaxis** | Same as the treatment regimen | | Secondary prophylaxis restarted when CD4<100 cells/µL[3] |
| **Primary Prophylaxis**<br>Indications:<br>CD4 < 50 cells/mm3<br>Ruled out active MAC and TB | Azithromycin 1250mg PO once weekly | Clarithromycin 500mg PO q12h | **Discontinuation:**<br>Consider if patient is on ART and viral load well suppressed, CD4 > 100 cells/µL for ≥3 months. |
| ***Cytomegalovirus* (CMV) Disease** | | | |
| **CMV Retinitis**<br>Immediate Sight-Threatening Lesions (Adjacent to the Optic Nerve or Fovea) | Intravitreal injections of Ganciclovir (2mg/injection) biweekly until scarring<br>**PLUS**<br>Ganciclovir 5mg/kg IV q12h<br><br>followed by maintenance therapy* | Intravitreal Foscarnet (2.4mg/ injection) biweekly until scarring<br>**PLUS**<br>Valganciclovir 900mg PO q12h<br><br>followed by maintenance therapy* | Duration of initial therapy:<br>14-21 days<br><br>*Maintenance therapy involving long duration IV Ganciclovir or high-cost Valganciclovir may not be feasible in resource-limited settings. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **CMV Retinitis**<br>For Small Peripheral Lesions | Ganciclovir 5mg/kg IV q12h for 14 days<br><br>followed by maintenance therapy* | Valganciclovir 900mg PO q12h<br><br>followed by maintenance therapy* | Given that early immune recovery is essential in preventing CMV relapses, ART should be started within 2 weeks of CMV treatment and clinical improvement. |
| **Extraocular CMV diseases** (Oesephagitis, colitis, interstitial pneumonitis, neurological) | Ganciclovir 5mg/kg IV q12h<br><br>followed by maintenance therapy* | May consider switch to Valganciclovir 900mg PO q12h once patient can absorb and tolerate orally (in CMV oesophagitis and colitis only)<br><br>followed by maintenance therapy* | Duration of initial therapy: 21-42 days or until resolution of signs and symptoms.<br><br>*Maintenance therapy involving long duration IV Ganciclovir or high-cost Valganciclovir may not be feasible in resource-limited settings.<br><br>Early immune recovery in response to successful ART is essential in preventing CMV relapses. |
| **Maintenance therapy/ Secondary prophylaxis** (CD4 count <100 cells/mm3) | Ganciclovir 5mg/kg IV q24h<br>5–7 times weekly | Valganciclovir 900mg PO q24h | **Discontinuation:**<br>Consider in patients with CD4>100 cells/µL and undetectable HIV viral load in response to successful ART.<br><br>Maintenance therapy involving long duration IV Ganciclovir or high-cost Valganciclovir may not be feasible in resource-limited settings. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Early immune recovery in response to successful ART is essential in preventing CMV relapses. |
| **Bacterial Enteric Infections** | | | |
| **Salmonellosis**<br>*Salmonella* non-typhi | Ciprofloxacin 500-750mg PO q12h **OR**<br>400mg IV q12h | Trimethoprim/sulfamethoxazole 160/800mg IV/PO q12h<br>**OR**<br>Ceftriaxone 2g IV q24h<br>**OR**<br>Ampicillin 2g IV q4-6h | **Duration:**<br>*Without bacteremia:*<br>CD4≥200 cells/µL: 7-14 days.<br>CD4 <200 cells/µL: 2-6 weeks<br><br>*With bacteremia:*<br>CD4≥200 cells/µL: At least 14 days or longer duration if persistent bacteremia or complicated with metastatic foci of infections.<br>CD4<200 cells/µL: 2-6 weeks<br><br>Secondary prophylaxis should be considered in patients with recurrent salmonella bacteremia.<br><br>Effective ART may decrease the risk of recurrence of salmonella infections |
| **Herpes Simplex Virus (HSV) Infections** | | | |
| Refer to section (Sexually Transmitted Infection) | | | |
| **Varicella-Zoster Virus Diseases** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Refer to section (Skin and Soft Tissue Infection (SSTI)) | | | |
| **Histoplasmosis (*Histoplasma capsulatum*)** | | | |
| **Moderate-to-severe disseminated disease** | **Induction therapy**<br>Amphotericin *0.7-1 mg/kg IV q24h for at least 2 weeks or clinical improvement, followed by<br><br>**Maintenance therapy**<br>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.<br><br>*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 months. | Fluconazole 800 mg PO q24h<br>**OR**<br>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 Suppressive therapy (Secondary prophylaxis)**<br><br>Indication:<br>- severe disseminated or CNS infection after completion of at least 12 months of treatment | Itraconazole 200mg PO q24h | Fluconazole 400mg PO q24h | **Discontinuation:**<br>• Received azole for >1 year, and<br>• Negative fungal blood cultures, and<br>• CD4 count >150 cells/µL and viral load suppressed in response to ART. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| - relapsed despite appropriate initial therapy CD4<150 | | | |
| ***Cystoisospora belli* infection** | | | |
| Initial Therapy | Trimethoprim/sulfamethoxazole 160/800mg PO/IV q6h | *Pyrimethamine 50-75mg PO q24h<br>**PLUS**<br>Folinic acid 5-10mg PO q24h<br><br>**OR**<br>Ciprofloxacin 500mg PO q12h | Duration: 10 days<br><br>*Requires special medicine approval |
| **Penicilliosis (*Talaromyces marneffei* infection)** | | | |
| **Acute infection** | *Amphotericin B 0.6-0.7mg/kg IV for 2 weeks **(induction therapy)**, followed by **consolidation therapy** Itraconazole 200mg PO q12h for 10 weeks | *If Amphotericin B is not available or not tolerated by patients:*<br><br>**Induction therapy:**<br>Voriconazole 6 mg/kg IV q12h for 1 day, then voriconazole 4 mg/kg IV q12h for 2 weeks<br>**OR**<br>Voriconazole 600 mg PO q12h on day 1, then Voriconazole 400 mg PO q12h for 2 weeks,<br><br>followed by 10 weeks of **consolidation therapy** with:<br><br>Voriconazole 200 mg PO q12h<br>**OR** | *The lipid formulations of amphotericin B may be used instead if available.<br><br>Patients must be on maintenance therapy after treatment of acute infections. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | Itraconazole 200 mg PO q12h | |
| **Maintenance therapy/ Secondary prophylaxis** | Itraconazole 200mg PO q24h | Fluconazole 400mg PO q24h | **Discontinuation:**<br>CD4 count >100 cells/mm3 and HIV viral load suppressed in response to ART. |
| **Progressive Multifocal Leukoencephalopathy (PML)** | | | |
| ***Polyoma virus JC virus (JCV)*** | No effective therapy exists | | With ART, some patients improve and others stabilise. Few may deteriorate due to immune reconstitution. |
| **Cryptosporidiosis** | | | |
| ***Cryptosporidium* sp.** | Symptomatic treatment of diarrhoea | | Effective ART (to increase CD4 >100 cells/µL) can result in complete, sustained clinical, microbiological and histologic resolution. |
| **Rhodococcus infection** | | | |
| **Induction Treatment** | *Vancomycin 15-20mg/kg (actual body weight) IV q8-12h<br><br>**PLUS (antibiotics with intracellular activity)**<br><br>Azithromycin 500mg stat and then 250mg IV/PO q24h | Addition of 4th drug should be considered in patients who are not responding clinically or with CNS involvement.<br><br>**4th drug:**<br>Imipenem/cilastatin 500mg IV q6h | *Consider Vancomycin loading dose 25-30mg/kg for critically ill or septic patients. Aim trough level 15-20mcg/mL<br><br>Once susceptibility data are available, two active agents should be continued (at least one of these should be macrolide or quinolone). |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **PLUS**<br>Ciprofloxacin 500-750mg PO q12h or 400 mg IV q8-12h | | For patients with CNS involvement, the second agent has to be with good CNS penetration (eg. Imipenem/cilastatin, vancomycin or rifampicin) since macrolide and quinolone have poor penetration into CSF.<br><br>Duration of treatment: 4-8 weeks (Longer courses should be administered to patients who have persistent clinical or radiographic evidence of infection). |
| **Maintenance/ Secondary prophylaxis** | Azithromycin 250mg PO q24h<br>**PLUS**<br>Ciprofloxacin 500-750mg PO 12h | *Rifampicin 600mg PO 24h<br>**PLUS**<br><br>Azithromycin 250mg PO 24h<br>**OR**<br>Ciprofloxacin 500-750mg PO 12h | *Alternative regime can be used if concomitant tuberculosis can be ruled out<br><br>**Discontinuation:**<br>Consider in patients with CD4>200 cells/µL and undetectable HIV viral load in response to successful ART. |

**Reference:**


1) Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents with HIV. National Institutes of Health, Centers for Disease Control and Prevention, and the HIV Medicine Association of the Infectious Disease Society of America NAG (updated June 2022)

## OBSTETRICS & GYNAECOLOGICAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Septic Abortion**<br><br>Common organisms:<br>● *Bacteroides* sp.<br>● *Streptococcus* sp.<br>● *Enterobacterales*<br>● *Chlamydia trachomatis*<br>● *Ureaplasma urealyticum* | Ampicillin 2g IV q4- 6h<br>**PLUS**<br>Gentamicin 5mg/kg IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Ampicillin/sulbactam 3g IV q6h<br>**PLUS**<br>Doxycycline 100mg PO q12h<br><br>**OR**<br><br>Clindamycin 900mg IV q8h<br>**PLUS**<br>Gentamicin 5mg/kg IV q24h | 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 antibiotic prophylaxis (IAP) for Group B *Streptococcus* (GBS) positive mothers**<br><br>Indications of IAP:<br>● Previous infant with invasive GBS disease<br>● Preterm labour<br>● GBS carriage in previous pregnancy<br>● PPROM with known GBS carrier<br>● GBS carriage in current pregnancy | Benzylpenicillin 5MU IV initial dose, then 2.5-3MU IV q4h until delivery | Ampicillin 2g IV initial dose, then 1g IV q4h until delivery.<br><br>**Mild penicillin allergy:**<br>Cefazolin 2g IV initial dose, then 1g q8h until delivery<br>**OR**<br>Cefuroxime 1.5g IV stat and 750mg IV q8h until delivery<br><br>**Severe penicillin allergy:**<br>Vancomycin 15-20mg/kg IV q8-12h until delivery<br>**OR**<br>Clindamycin 900mg IV q8h until delivery | Prophylaxis begins at hospital admission for labour or rupture of membrane and continues every four hours until the infant is delivered.<br><br>Treatment **is NOT INDICATED** if C-section is performed before onset of labour with intact membrane (please use standard surgical prophylaxis).<br><br>Antenatal treatment is **NOT RECOMMENDED** for GBS cultured from a vaginal or rectal swab. |
| **Preterm Premature Rupture of Membranes (PPROM)** | **If non-GBS carrier:** | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Erythromycin ethylsuccinate 400mg PO q6h for 7-10 days<br><br>**If GBS carrier:**<br>Ampicillin 2g IV q6h for 48 hours,<br>followed by<br>Amoxicillin 500mg PO q8h for an additional 5-7 days or until delivery, whichever comes first<br>**PLUS**<br>One dose of Azithromycin 1g PO upon admission<br>(to cover for *Ureaplasma* – important cause of chorioamnionitis & chlamydia) | | |
| **Chorioamnionitis** | Ampicillin 2g IV q6h<br>**PLUS**<br>Gentamicin 5mg/kg IV q24h<br><br>**If the patient is undergoing a caesarean delivery:**<br>**PLUS**<br>Metronidazole 500mg IV q8h | Ampicillin/sulbactam 3g IV q6h<br><br>**Mild penicillin allergy:**<br>Cefazolin 2g IV q8h<br>**PLUS**<br>Gentamicin 5mg/kg IV q24h<br><br>**Severe penicillin allergy:**<br>Clindamycin 900mg IV q8h | Antibiotic regimen is continued postpartum until the patient is afebrile and asymptomatic for **AT LEAST 48 HOURS**.<br><br>There is NO evidence that continuation with oral antibiotics is beneficial after discontinuation of parenteral therapy. |
| **Pelvic Inflammatory Disease**<br><br>Common organisms:<br>● *Neisseria gonorrhoeae*<br>● *Chlamydia trachomatis*<br>● *Bacteroides* sp. | **Outpatient regimen (Mild-moderate):**<br>Ceftriaxone 500mg IM in a single dose<br>**OR**<br>Cefotaxime 1g IM in a single dose<br><br>**PLUS** | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| ● *Enterobacterales*<br>● *Haemophilus influenzae*<br>● *Streptococcus* sp. especially *Streptococcus agalactiae (GBS)*<br>● *Gardnerella vaginalis*<br>● *Ureaplasma urealyticum*<br>● *Mycoplasma hominis* | Metronidazole 400mg PO q12h for 14 days<br>**PLUS**<br><br>Doxycycline 100mg PO q12h for 14 days<br>**OR**<br>Azithromycin 1g PO once a week for 2 weeks | | |
| | **Inpatient regimen (Moderate-severe):**<br>Cefuroxime 1.5g IV q8h<br>**OR**<br>Ceftriaxone 2g IV q24h<br><br>**PLUS**<br>Doxycycline 100mg PO q12h<br>**PLUS**<br>Metronidazole 500mg IV/PO q8h<br><br>**Duration of treatment: 14 days** | Ampicillin/sulbactam 3g IV q6h<br>**PLUS**<br>Doxycycline 100mg PO q12h | **Tubo-ovarian abscess:**<br>Surgical intervention for source control may be required. May need to consider tuberculosis if not responding to standard treatment. |
| **Endometritis** | **Non-pregnancy:**<br>Follow antibiotic guide for severe PID | | |
| | **Postpartum endometritis:**<br>Clindamycin 900mg IV q8h<br>**PLUS**<br>*Gentamicin 5mg/kg q24h<br><br>**OR**<br><br>Cefotaxime 1g IV q8h | Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q6h | Duration of treatment: 10-14 days<br><br>*TDM for gentamicin is required |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **PLUS**<br>Metronidazole 500mg IV q8h<br>**PLUS**<br>*Gentamicin 5mg/kg IV x 1 dose | | |
| **Vaginitis**<br>Bacterial vaginosis | Metronidazole 400mg PO q8h for 7 days | Clindamycin 300mg PO q12h for 7 days | Metronidazole can be used in any stage of pregnancy |
| **Vaginal Candidiasis**<br>*Candida albicans* | **Uncomplicated infection**:<br>Clotrimazole 500mg as a single vaginal pessary (stat dose)<br>**OR**<br>Clotrimazole 200mg as vaginal pessary for 3 nights | Fluconazole 200mg PO for one dose | Pregnancy:<br>If indicated, treatment with topical therapy as oral therapy is **CONTRAINDICATED**. |
| | **Complicated infections:**<br><u>Severe vaginitis symptoms</u><br>Fluconazole 150-200mg PO q72h for 2 or 3 doses<br><u>Recurrent vulvovaginal candidiasis</u><br>Fluconazole 200mg PO q72h for 3 doses then weekly for 6 months | Clotrimazole 500mg vaginal suppository once weekly for 6 months | |
| **Trichomoniasis**<br>*Trichomonas vaginalis* | Metronidazole 400mg PO q8h for 7 days<br>**OR**<br>Metronidazole 2g PO as single dose | | Metronidazole can be used in any stage of pregnancy.<br><br>If postpartum and breastfeeding, it is not advisable to breastfeed during treatment. May resume breastfeeding after 24 hours of the last dose. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Cervicitis** | Azithromycin 1g single dose | Doxycycline 100mg PO q12h for 7 days | |
| **Postpartum mastitis**<br><br>Common organisms:<br>● *Staphylococcus aureus* (MSSA)<br>● *Streptococcus pyogenes* (Grp A, B)<br>● *Escherichia coli*<br>● *Bacteroides* sp<br>● *Corynebacterium* sp<br>● *CoNS* | **Outpatient:**<br>Cephalexin 500mg PO q6h for 5-7 Days | | Duration of therapy for 5-7 days may be adequate but if poor response consider extending to 10-14 days.<br><br>Milk culture for less severe infection.<br><br>If severe infection (hemodynamic instability), blood culture required. |
| | **Inpatient:**<br>Cloxacillin 2g IV q6h | Cefazolin 1-2g IV q8h | |
| **Post Lower Segment Cesarean Section (LSCS) infection** | In mild surgical site infections (SSI), antibiotics are generally not indicated.<br>Appropriate dressing is the primary treatment. | | |
| | Cloxacillin 2g q6h<br>**OR**<br>Cefazolin 1-2g IV q8h | **Risk of Gram-negative or anaerobic infection (eg: diabetes):**<br>Ampicillin/sulbactam 3g IV q6-8h | |


**References:**

1. Savaris RF, de Moraes GS, Cristovam RA, Braun RD. Are antibiotics necessary after 48 hours of improvement in infected/septic abortions? A randomised controlled trial followed by cohort study. *Am J ObstetGynecol*.2011;204(4):301.e1.Epub 2010 Dec31
2. Mackeen A, Packard RE, Ota E, Speer L. Antibiotic Regimens for postpartum endometritis. Cochrane Database Syst Rev 2:2015
3. Prevention of early-onset Group B Streptococcal Disease in newborns. Committee Opinion No. 485.American College of Obstetricians and Gynecologists. *ObstetGynecol* 2011;117:1019-27
4. Hughes RG, Brocklehurst P, Steer PJ, Heath P, Stenson BM on behalf of the Royal College of Obstetricians and Gynaecologists. Prevention of
5. Early-onset neonatal group B streptococcal disease. Green-top Guideline No. 36. *BJOG* 2017;124:e280–e305.
6. NICE Guideline.Preterm Labor and birth.https://www.nice.org.uk/guidance/ng25/resources/preterm-labour-and-birth

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


7. Hemsell DL, Little BB, Faro S et al. Comparison of three regimens recommended by the Centers for Disease Control and Prevention for the treatment of women hospitalised with acute pelvic inflammatory disease. *Clin Infect Dis* 1994;19(4):720-727
8. UK National Guideline for Management of Pelvic Inflammatory Disease 2011. Clinical Effectiveness Group British Association for Sexual Health and HIV. 2011
9. World Health Organization; Mastitis: causes and management; Geneva, Switzerland; accessed21/3/2018
10. Workowski KA, Bolan GA, Centers for Disease Control and Prevention: Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recomm* Rep 64:1, 2015
11. Antibiotic prophylaxis for prevention of postpartum perineal wound complications: a randomised controlled trial, 2008
12. WHO guidelines for the management of postpartum haemorrhage and retained placenta, 2009

## OCULAR INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Dose alteration may be needed for systemic and intravitreal antibiotics in paediatric patients. | | | |
| **Blepharitis**<br>*Staph. aureus*<br>*Staph. epidermidis* | Eyelid hygiene/scrubs is the mainstay of therapy<br><br>Topical antibiotics are not indicated as an initial therapy | Oxytetracycline with Polymyxin B eye ointment applied q12h to the lid margin<br>**OR**<br>Fusidic Acid 1% eye ointment applied q12h to the lid margin | |
| **Meibomian gland dysfunction** | Warm compression and massage<br><br>Systemic therapy is not indicated as an initial therapy | In resistant cases,<br>Doxycycline 100mg PO q12h for 4-6 weeks<br>**OR**<br>Azithromycin 500mg PO q24h for 3 days | Tetracyclines are contraindicated in children < 8 years old |
| **Internal Hordeolum** with Secondary Infection<br>*Staph. aureus*<br><br>Systemic antibiotics are indicated in the presence of superficial cellulitis or abscess | Warm compresses<br><br>Cloxacillin 500mg PO q6h for 5 days | -<br><br>Amoxicillin/clavulanate 625mg PO q8h for 5 days | |
| **External Hordeolum (Stye)**<br>*Staph. aureus* | Epilation of affected eye lash and warm compresses<br>No antibiotic recommended as condition is self-limiting | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| In the presence of superficial cellulitis or abscess | Cloxacillin 500mg PO q6h for 5 days | Amoxicillin/clavulanate 625mg PO q8h for 5 days | |
| **Bacterial Conjunctivitis**<br>*Staph. aureus*<br>*Strep. pneumonia*<br>*Haemophilus influenzae* | Chloramphenicol 0.5% eye drop q4h | Levofloxacin 0.5% eye drop q6h<br>**OR**<br>Moxifloxacin 0.5% eye drop q6h<br>**OR**<br>Ciprofloxacin 0.3% eye drop q6h | |
| **Gonococcal Conjunctivitis**<br>(including neonates)<br>*Neisseria gonorrhoeae* | Requires systemic therapy. Refer to Sexually Transmitted Infections | | Copious irrigation with topical saline drops or artificial tears every 30-60 minutes.<br><br>Topical antibiotic may considered as ancillary therapy. |
| **Bacterial Keratitis**<br>No Growth | Ciprofloxacin 0.3% eye drop q1-2h<br>**OR**<br>Moxifloxacin 0.5% eye drop q1-2h<br>**OR**<br>Levofloxacin 0.5% eye drop q1-2h | *Cefuroxime 5% eye drop q1-2h<br>**PLUS**<br>*Gentamicin 0.9% or 1.4% 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.<br><br>*Prepared ready to use extemporaneous by using injectable forms |
| **Contact Lens Related Bacterial Keratitis**<br>No Growth | Ciprofloxacin 0.3% eye drop q1-2h<br>**OR**<br>Levofloxacin 0.5% eye drop q1-2h | *Gentamicin 0.9% or 1.4% eye drop q1-2h<br>**Plus**<br>*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 |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | clock. Taper based on clinical response.<br><br>*Prepared ready to use extemporaneous by using injectable forms |
| **Bacterial Keratitis**<br>Gram-positive cocci<br><br><br><br><br><br>Gram-negative rods | Moxifloxacin 0.5% eye drop q1-2h<br><br><br><br><br><br>Ciprofloxacin 0.3% eye drop q1-2h<br>**OR**<br>Levofloxacin 0.5% eye drop q1-2h | *Cefuroxime 5% eye drop q1-2h<br><br>**For MRSA**<br>* Vancomycin 5% eye drop q1-2h<br><br><br>*Gentamicin 0.9% or 1.4% eye drop q1-2h<br>**PLUS**<br>*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.<br><br>*Prepared ready to use extemporaneous by using injectable forms |
| **Acanthamoeba Keratitis**<br>*Acanthamoeba* sp. | *Chlorhexidine 0.02% eye drop q1-2h | **Propamidine isethionate 0.1% q1-2h | Topical therapy tapered with response over a duration of 6-12 months.<br><br>*Prepared ready to use extemporaneous by using injectable forms<br><br>**Requires special medicine approval |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Fungal Keratitis**<br>Filamentous Fungi/Yeast | *Fluconazole 0.2% eye drop q1-2h<br>**OR**<br>*Amphotericin B 0.15-0.2% eye drop q1-2h | */**Voriconazole 1% eye drop q1-2h<br>**OR**<br>**Natamycin 5% eye drop q1-2h<br><br>**<u>Oral Therapy:</u>**<br>**May be considered in the absence of contraindications**<br>Ketoconazole 200mg PO q24h<br>**OR**<br>Fluconazole 200mg PO q24h | Natamycin is the choice therapy for *Fusarium*.<br><br>Amphotericin B is the choice therapy for candida.<br><br>In severe fungal keratitis, combination therapy may be used.<br><br>*Prepare ready to use extemporaneous<br><br>**Requires special medicine approval |
| **Herpes simplex Keratitis**<br>Herpes simplex Type 1 & 2<br><br>Epithelial Keratitis<br><br>In the presence of stromal or endothelial disease<br><br>Recurrent Herpes Simplex Stromal Keratitis | Acyclovir 3% eye ointment 5 times/day<br><br>Acyclovir 400mg PO 5 times/day for 7-14 days<br><br>Prophylaxis:<br>Acyclovir 400mg PO q12h for 12 months | | For stromal and endotheliitis: Combination with intensive topical steroid is required. |
| **Herpes zoster Ophthalmicus**<br>Herpes zoster virus | Needs systemic therapy.<br>Refer to Skin & Soft Tissue Infections Section | | |
| **Ocular Toxoplasmosis**<br>*Toxoplasma gondii* | Trimethoprim**/s**ulfamethoxazole 160/800mg PO q12h for at least 6 weeks | *Pyrimethamine 25-50mg PO q24h<br>**PLUS** | Pregnancy : May consider Intravitreal Clindamycin 1.0mg /0.1ml |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | Folinic acid 10-25mg PO q24h<br>**PLUS**<br><br>*Sulfadiazine 1g PO q6h<br>**OR**<br>Azithromycin 500mg PO q24h<br>**OR**<br>Clindamycin 300mg PO q6h for 3-4 weeks, then 150mg q6h PO for 3-4 weeks | Systemic steroids are usually indicated in immunocompetent patients<br><br>*Requires special medicine approval<br><br>**Prophylaxis for recurrent lesions:**<br>Trimethoprim/ulfamethoxazole 80/400mg q12h PO 3 times a week |
| **Acute Retinal Necrosis**<br>Herpes simplex virus | Acyclovir 10mg/kg/dose (not more than 800mg) IV q8h for 10-14 day<br><br>**Followed by**<br>Acyclovir 800mg PO 5 times/day for 6 weeks | *Valacyclovir 1g PO q8h for 6 weeks | *Requires special medicine approval<br><br>Systemic steroid is indicated depending on location or severity of the infection. |
| **CMV Retinitis**<br>*Cytomegalovirus* | **Systemic therapy**<br>Ganciclovir 5mg/kg IV q12h for 2-3 weeks<br><br>**Intravitreal therapy**<br>Intravitreal Ganciclovir 2mg/0.1ml biweekly | **Systemic therapy**<br>Valganciclovir 900mg PO q12h for 3 weeks (induction)<br>**Followed by**<br>900mg PO q24h (maintenance)<br><br>**Intravitreal therapy**<br>Intravitreal *Foscarnet 2.4mg/0.1ml (1-2 weekly) | Systemic therapy is indicated in all cases.<br><br>Maintenance may need to continue until CD4 count is > 150 cells/$mm^3$ for 3 consecutive months.<br><br>Intravitreal therapy is indicated in zone 1 and 2 lesions.<br><br>Intravitreal to be tapered according to clinical response. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Ganciclovir implant: 4.5g an option for prolonged use of intravitreal Ganciclovir<br><br>*Requires special medicine approval |
| **Ocular Syphilis**<br>*Treponema pallidum* | Ocular Syphilis (syphilitic uveitis) should be treated as Neurosyphilis.<br>Refer to Sexually Transmitted Infections Section | | Referral to Dermatologist/ID Physician |
| **Ocular Tuberculosis**<br>*Mycobacterium tuberculosis* | Needs systemic therapy<br>Refer to MOH CPG on Management of Tuberculosis (Extra-pulmonary TB) Section<br><br>*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 may be 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.<br><br>**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. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Systemic steroid may be indicated but is only for<br>- non-active systemic TB<br>- immunocompetent patients<br>-severe ocular inflammation developing after starting anti-TB treatment<br>- vision threatening condition<br><br>Systemic steroid should NOT be started alone without anti-TB treatment |
| **Post-operative Bacterial Endophthalmitis**<br>*Staphylococcus epidermidis*<br>*Staphylococcus aureus*<br>*Pseudomonas aeruginosa,*<br>*Bacteroides* Species<br>*Streptococcus pneumoniae,*<br>*Alpha-Haemolytic streptococci* | **Intravitreal antibiotic injections**<br>Vancomycin 1-2mg/0.1ml<br>**PLUS**<br>Ceftazidime 2mg/0.1ml<br><br>If suspicious of fungal endophthalmitis:<br>**ADD**<br>Intravitreal Amphotericin B 0.005mg/0.1ml<br><br>**OR**<br><br>**Topical treatment-options:**<br>(monotherapy or combination)<br>*Ceftazidime 5% eye drop<br>*Vancomycin 5% eye drop<br>*Gentamicin 1.4% eye drop<br>*Cefuroxime 5% eye drop | **Intravitreal antibiotic injections:**<br>Vancomycin 1-2mg/0.1ml<br>**PLUS**<br>Amikacin 0.4mg/0.1ml | Endogenous endophthalmitis: Treatment is based on primary infection (bacterial/fungal etc) and culture and sensitivity results.<br><br>Systemic antibiotics are indicated in severe, virulent endophthalmitis.<br><br>Repeat intravitreal antibiotics after 48 to 72 hours if indicated.<br><br>*Prepared ready to use extemporaneous by using injectable forms |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Moxifloxacin 0.5% eye drop<br>Levofloxacin 0.5% eye drop<br><br>**OR**<br><br>**Systemic treatment**<br>Ciprofloxacin 750mg PO q12h for 10 days<br><br>For culture negative cases,<br>**ADD**<br>Clarithromycin 250-500mg PO q12h for 7-14 days | **Systemic treatment**<br>Vancomycin 15-20mg/kg IV q8-12h (not to exceed 2g per dose)<br>**PLUS**<br>Ceftazidime 1-2g IV q8h | |
| **Post-operative Fungal Endophthalmitis** | Intravitreal Amphotericin B 0.005mg/0.1ml<br><br>**OR**<br><br>**Systemic Therapy**<br>Fluconazole 200mg PO q24h for 6 weeks (minimum) | *Intravitreal Miconazole 0.01mg/0.1ml<br>**OR**<br>*Intravitreal Voriconazole 50-100 ug/0.1ml<br><br>**OR**<br><br>**Systemic Therapy**<br>*Voriconazole 200mg PO q12h | Intravitreal and Systemic therapy are indicated in all cases<br><br>*Requires special medicine approval |
| **Endogenous Endophthalmitis** | **Systemic treatment**<br>Ciprofloxacin 750mg PO q12h for 10 days<br><br>For culture negative cases:<br>**ADD**<br>Clarithromycin 250-500mg PO q12h for 7-14 days | **Systemic treatment**<br>Vancomycin 15-20mg/kg IV q8-12h (not to exceed 2g per dose)<br>**PLUS**<br>Ceftazidime 1-2g IV q8h | Treatment is based on primary infection (bacterial/fungal etc) and culture and sensitivity results.<br><br>All cases require systemic therapy. Intravitreal injection is indicated in cases with vitreous involvement and sight threatening choroidal lesions. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **OR**<br><br>**Topical treatment-options**<br>(monotherapy or combination)<br>*Ceftazidime 5% eye drop<br>*Vancomycin 5% eye drop<br>*Cefuroxime 5% eye drop<br>Gentamicin 0.3% eye drop<br>Moxifloxacin 0.5% eye drop<br>Levofloxacin 0.5% eye drop<br><br>**OR**<br><br>**Intravitreal antibiotic injections:**<br>Vancomycin 1-2mg/0.1ml<br>**PLUS**<br>Ceftazidime 2mg/0.1ml<br><br>If suspicious of fungal endophthalmitis,<br>**ADD**<br>Intravitreal Amphotericin B 0.005mg/0.1ml | **Intravitreal antibiotic injections:**<br>Vancomycin 1-2mg/0.1ml<br>**PLUS**<br>Amikacin 0.4mg/0.1ml | Topical therapy may supplement therapy. Not to use systemic steroids in these cases<br><br>Review antibiotic regimen after microbiology results. Repeat intravitreal antibiotics after 48 to 72 hours if indicated<br><br>*Prepared ready to use extemporaneous by using injectable forms |
| **Dacryocystitis**<br>*Strep pneumoniae*<br>*Staph aureus*<br>Gram-positive anaerobes | Cefuroxime 250mg PO q12h for 7 days | Amoxicillin/clavulanate 625mg PO q8h for 7 days | Consider intravenous antibiotics in severe infections |
| **Preseptal Cellulitis**<br>*Strep pneumoniae*<br>*Staph aureus*<br>*Streptococcus* sp. | Cloxacillin 500mg-1g PO q6h for 5 days | Amoxicillin/clavulanate 625mg PO q8h for 7 days<br>**OR**<br>Ceftriaxone 1-2g IV q24h | Consider intravenous antibiotics in severe infections |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Orbital Cellulitis/abscess**<br>*Strep pneumoniae*<br>*Staph aureus*<br>*Streptococcus* sp.<br>Gram-positive anaerobes | Amoxicillin/clavulanate 1.2g q8h IV for 7-10 days | Ceftriaxone 1-2g q24h IV for 7-10 days<br><br>If anaerobes suspected:<br>**ADD**<br>Metronidazole 500mg IV q8h for 7-10 days | |

**References:**


1. Sobrin L, Kump L, Foster CS. Intravitreal clindamycin for toxoplasmicretinochoroiditis Retina 2007. Sep; 27(7): 952-7.
2. Patrick MKT, Claire Y H, Susan L. Antiviral selection in the management of acute retinal necrosis. Clinical Ophthalmology 2010:4 11–20
3. 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.
4. 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 Ophthalmol2007;91:1452–1455
5. Simon RJT, Robin H, Claire YH, Sue Lightman. Valacyclovir in the treatment of acute retinal necrosis. BMC Ophthalmology 2012, 12:48.
6. Robert WW, Emmett TC et al. Diagnosing and Managing Acute Retinal Necrosis. Retinal Physician.
7. Helm CJ, Holland GN. Ocular tuberculosis. SurvOphthalmol. 1993 Nov-Dec;38(3):229-56
8. Bodaghi B1, LeHoang P. Ocular tuberculosis. CurrOpinOphthalmol. 2000 Dec;11(6):443-8
9. CPG for Management of Post- Operative Endophthalmitis, Ministry of Health Malaysia, August 2006
10. Periorbital and orbital cellulitis: A 10 year review of Hospitalized children. *Eur J Ophthalmol 2010;20(6): 1066-1072*
11. Microbiology and Antibiotic Management of Orbital Cellulitis *Pediatrics 2011;127;e566*

## ORAL/DENTAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **A. ANTIMICROBIAL USE FOR BACTERIAL INFECTIONS** | | | |
| **1. Infections of the Teeth and Supporting Structures** | | | |
| **Reversible/ Irreversible Pulpitis** | Systemic antibiotic use not recommended | Systemic antibiotic use not recommended | |
| **Localized Dentoalveolar Abscess** | **Superficial**<br>Systemic antibiotic use not recommended (unless medically compromised)<br><br>**Deep Infection/Medically Compromised**<br>Amoxicillin 500mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8h<br><br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h | Systemic antibiotic use not recommended (unless medically compromised)<br><br>**Penicillin Allergy:**<br>Clindamyin 300mg PO q6h | |
| **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 |
| **Localized 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 |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Chronic Gingivitis** | Systemic antibiotic use not recommended | | First line treatment: Mechanical and chemical plaque control.<br><br>0.2% Aqueous Chlorhexidine Gluconate not be used alone but as an adjunct to mechanical debridement.<br><br>Second line treatment-Antimicrobial mouth rinse |
| **Chronic Periodontitis**<br><br>Antibiotic can be considered in cases of:<br>1. Unresponsive to conventional mechanical therapy<br>2. Acute infection with systemic manifestation<br>3. Medically compromised | Systemic antibiotic use is generally not recommended.<br><br>Amoxicillin 500mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8h<br><br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h | Systemic antibiotic use is generally not recommended.<br><br>**Penicillin Allergy:**<br>Clindamyin 300mg PO q6h | First line treatment: Mechanical plaque control |
| **Aggressive Periodontitis**<br><br>*Aggregatibacter actinomycetemcomitans*<br>*Porphyromonas gingivalis*<br>*Tannerellafor sythensis*<br>*Prevotella intermedia*<br>Spirochaetes | Amoxicillin 500mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8h | **Penicillin Allergy:**<br>Clindamyin 300mg PO q6h | Antibiotics are not used alone but are used as an adjunct to scaling and root debridement. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Local missed Periodontal Abscess** | Systemic antibiotic use not recommended | | Incision and Drainage<br><br>Management of cause of abscess and symptomatic relief of pain |
| **2. Infections of the Jaws** | | | |
| **Osteomyelitis of the jaws of dental origin**<br><br>Different organisms may be involved | For **acute cases**, start with:<br>Amoxicillin 500mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8h<br><br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h | **Penicillin Allergy:**<br>Clindamycin 300-450mg PO/IV q6h | Culture and sensitivity is necessary to guide the antibiotic.<br><br>For **chronic cases**, start with surgical treatment first. Antibiotics only when causative organisms are identified.<br><br>Duration of antibiotic therapy can be 4-6 weeks depending on patient response/microbiological clearance of the pathogen. |
| **3. Spreading Infections and Infections of Fascial Spaces (with/without Systemic Signs)** | | | |
| **Cellulitis ± Abscess of dental origin**<br><br>Viridans Streptococci<br>*Staphylococci*<br>*Prevotella*<br>*Peptostreptococcus*<br>*Fusobacterium nucleatum*<br>*Clostridium* sp | Benzylpenicillin 2-4MU IV q4-6h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**OR**<br>Amoxicillin/clavulanate 1.2g IV q6-8h (not more than 1.2g in a single dose- max 7.2g daily)<br><br>**OR** | **Penicillin Allergy:**<br>Clindamycin 300-450mg PO/IV q6h | Empirical antibiotics are started.<br><br>Incision and drainage is advised and antibiotics is changed in accordance with result of culture and sensitivity. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Surgical site infection & Traumatic wound infection**<br>(Infection is usually by endogenous organisms rather than exogenous)<br><br>*Viridans Streptococci*<br>*Staphylococci*<br>*Prevotella*<br>*Peptostreptococcus,*<br>*Eubacterium,*<br>*Fusobacterium nucleatum* | Cefuroxime 750mg-1.5g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**OR**<br>If not responding to above antibiotics,<br>Ceftriaxone 1-2g IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**<u>Step Down/Oral therapy</u>**<br>Amoxicillin 250-750mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8-12h<br><br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h<br><br>**OR**<br><br>Cefuroxime 250-500mg PO q12h<br>**PLUS**<br>Metronidazole 400mg PO q8-12h | **Penicillin Allergy:**<br>Clindamycin 300-450mg PO q6h | |
| **Traumatic wound involving skin/Infection of skin origin** | Cloxacillin 500mg-1g IV q6h (in skin involvement - if *Staph*. expected)<br>**OR**<br><br>Amoxicillin 250-750mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8-12h | **Penicillin Allergy:**<br>Clindamycin 300-450mg IV/PO q6h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **4. Post-implant Infections ("Peri-implantitis")** | | | |
| Causative Organisms:<br>*Actinomyces sp.*<br>*Eubacterium sp.*<br>*Propionibacterium sp.*<br>*Lactobacillus sp.*<br>*Veillonella sp.*<br>*Porphyromonas gingivalis*<br>*Prevotella intermedia*<br>*Fusobacterium nucleatum* | Amoxicillin/clavulanate 625mg PO q8h<br>**OR**<br><br>Amoxicillin 500mg PO q8h<br>**PLUS**<br>Metronidazole 400mg PO q8h | **Penicillin Allergy:**<br>Doxycycline 100mg PO q12h<br>**OR**<br>Clindamycin 300mg PO q6h | Bacteria associated with periimplantitis are extremely resistant to antibiotics.<br><br>Antibiotics are not used alone but are used as an adjunct to local mechanical and chemical debridement.<br><br>Also irrigation with chlorhexidine and optimal oral hygiene by patient.<br><br>Locally delivered antibiotics is preferred compared to systemic administration.<br><br>Currently there is no reliable study to suggest most effective antibiotic therapy. |

**References:**


1. Antibiotics and The Treatment of Endodontic Infections. Endodontics colleagues for Excellence 2006; American Association of Endodontics
2. JCan Dent Assoc 2003 Nov 69 (10):660 Clin.Microbiol.Rev.2013,26(2):255
3. Med Oral Patol Oral Cir Bucal 2005; 10:77-85
4. JClinMicrobiol.2003;41(12):5794-7 Journal of the Irish Dental Association 2009; 55 (4): 190 – 192
5. Clinical Periodontology-12thed.2014
6. Clinical Periodontology-9thed.2002
7. Periodontology 2000, Vol. 62, 2013, 218-231 CPG Management of chronic periodontitis Nov 2012 MOH,Malaysia
8. JClin Periodontol.2012;39:284-294
9. Clin Periodontol.2011;38:43-49
10. J Clin Periodontol 2008; 35: 696–704

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| 11. J Periodont Res 2012; 47: 137–148<br>12. Periodontology 2000. Jun2014, Vol. 65 Issue 1, p149-177. 29p. Malaysian Dental Journal (2008) 29(2) 154-157<br>13. CPG Management of periodontal abscess- MOH,Malaysia 2003<br>14. Eur J Oral Implantol 2012; 5 (Suppl): S21-S41<br>15. Clin Oral Impl Res 2012 (23): 205-210<br>16. Int.J Oral Maxillofac Implants 2014 (29): 325-345<br>17. Clin Oral Impl Res 2000:11(suppl): 146-155 | | | |
| **B. ANTIMICROBIAL USE FOR FUNGAL INFECTIONS** | | | |
| **Oral Candidiasis** | | | |
| **Oropharyngeal Candidiasis (Oral Thrush)** | Refer to section [Infections in Immunocompromised patients – HIV] | | |
| **Acute Pseudomembranous Candidiasis**<br><br>Hyperplastic Candidiasis (Candidal Leukoplakia)<br><br>Mild disease<br><br>Moderate to severe disease<br><br>Fluconazole-refractory disease | <br><br><br><br>Topical antifungal<br><br>Fluconazole 100-200mg PO q24h for 7-14 days<br><br>Itraconazole solution 200mg PO q24h | <br><br><br><br>Nystatin (oral suspension) 400,000-600,000units q6h for 7-14 days<br><br><br>Voriconazole 200mg PO q12h | |
| **Chronic Erythematous Candidiasis** | Local measures - denture cleansers, remove dentures at night | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| (*Candida*-associated denture stomatitis with and without angular cheilitis) | Soak dentures in chlorhexidine mouthwash 2%<br><br>Topical antifungals if local measures fail:<br>Nystatin (oral suspension)<br>500,000-1,000,000units q6h-8h<br>(to continue for 2 days after perioral symptoms disappeared or cultures show eradication of candida sp.) | | |

**References:**


1. Am Fam Physician. 2008;78(&):845-852 Journal of Oral Microbiology 2011,3:5771-DOI: 10.3402/jom.v3i0.5771
2. Med Oral Patol Oral Cir Bucal. 2011 Mar 1:16(2):el 39-43 Australia Dental Journal 2010; 55:(1 suppl):48
3. Clinical Practice Guideline for the management of candidiasis: 2016 update by IDSA


**C. ANTIMICROBIAL USE FOR VIRAL INFECTIONS**

| | | | |
|---|---|---|---|
| **Herpes simplex virus type 1 (HSV-1)**<br>-Primary herpetic gingivostomatitis<br>-Herpes labialis<br><br>**Herpes simplex virus type 2 (HSV-2)**<br>Epstein-Barr virus<br>E.g.: Infectious mononucleosis, oral hairy leukoplakia | **Symptomatic treatment in most cases**.<br><br>Can also consider:<br>1)**Topical Acyclovir** 5% cream q4h for 5-10 days in prodromal phase for recurrent herpes labialis<br><br>2) **Systemic antiviral**<br>Acyclovir 400-800mg PO 5 times daily for 7-14 days | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Varicella-zoster virus**<br><br>**Coxsackie virus**<br>-Herpangina<br>-Hand, foot and mouth disease | | | |
| **Severe Varicella/Herpes Infections or in immunocompromised patients** | Refer to section [Skin & Soft Tissue Infections – Viral Infections] | | **Varicella Zoster Infections:**<br>Advisable to start treatment for early within 48 hours of Varicella Infections<br><br>**Herpes infection:**<br>Topical antiviral treatment is not recommended.<br>Advisable to start treatment early within 48-72 hours and for all immunocompromised patient or for immunocompetent with following criteria:<br>- > 50 years years of age<br>- Have moderate to severe pain<br>- Have moderate to severe rash<br>- Have non-truncal involvement |
| **Viral Encephalitis**<br>Herpes simplex<br>Varicella zoster | Refer to section [Central nervous system (CNS) Infections – Viral Encephalitis] | | Duration: 10-21 days |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |

**References:**


1. Aust Dent J 2005;50 Suppl 2: S31- S35
2. Centers for Disease Control and Prevention (CDC) 2010

## OTORHINOLARYNGOLOGY INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |

**1. General Sore Throat**

The MsIsaac 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** | High risk | Perform throat culture. Treat with antibiotic only if culture positive |

**References:**


1. Empirical Validation of Guidelines for the Management of Pharyngitis in Children and Adults. JAMA. April 7, 2004; Vol 291 No 13: 1588-1595
2. The Infectious Disease Society of America (IDSA) 2012 Guidelines


**2. Throat and Upper Respiratory**

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Tonsillitis/Pharyngitis**<br>Group A *Streptococcus* | Phenoxymethypenicillin (Penicillin V) 500mg PO q6h or 1g PO q12h for 5-10 days<br><br>**If not tolerated orally:**<br>Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q6h<br>**OR**<br>Cefuroxime 750mg IV q8h | Amoxicillin 500mg PO q8h for 5-10 days<br><br>**Penicillin Allergy:**<br>Erythromycin Ethylsuccinate 800mg PO q12h for 5-10 days | |
| **Acute Peritonsillar Abscess**<br>Group A *Streptococcus*<br>*Staphylococcus aureus*<br>*Haemophilus influenzae*<br>*Fusobacterium necrophorum* | Ampicillin/sulbactam 3g IV q6h<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV q8h<br><br>**Penicillin Allergy:**<br>Clindamycin 600mg IV q8h | Amoxicillin/clavulanate 625 mg PO q8h<br><br>**Penicillin Allergy:**<br>Clindamycin 300-450mg PO q6h | Abscess to be drained |
| **Diphtheria**<br>*Corynebacterium diphtheriae* | Antitoxin<br>**PLUS**<br>Benzylpenicillin 50,000 units/kg to a maximum of 1.2 MU IV q12h, followed by Phenoxymethylpenicillin (Penicillin V) 250mg PO q6h for total of 14 days | | Diphtheria antitoxin:<br>Pharyngeal/ laryngeal disease of 2 days duration: 20,000-40,000 units<br>Nasopharyngeal disease: 40,000-60,000 units<br>Systemic disease of ≥3 days or any patient with diffuse neck swelling: 80,000-120,000 units |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Administer over 60 minutes to inactivate toxin rapidly |
| **Acute Epiglottitis**<br>*Haemophilus influenzae* Type B virus,<br>*Streptococcus pneumoniae* | Ceftriaxone 2g IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**OR**<br>Ampicillin/sulbactam 3g IV q6h<br><br>**<u>Oral step down therapy:</u>**<br>Amoxicillin/clavulanate 625mg PO q8h for 7–14 days | **Penicillin Allergy:**<br>Clindamycin 600-900mg IV q8h<br>**PLUS**<br>Ciprofloxacin 400mg IV q12h | Urgent hospitalisation. May present with life threatening upper airway obstruction, especially in paediatrics. |
| **Deep Neck Space Abscess**<br>*Streptococcus pyogenes*<br>*Staphylococcus aureus*<br>*Fusobacterium necrophorum* | Ampicillin/sulbactam 3g IV q6h<br><br>**OR**<br><br>Ceftriaxone 2g IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q6h | | Duration: 10-14 days |
| **3. Rhinology** | | | |
| **Acute Bacterial Rhinosinusitis (ABRS)**<br>*Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis* | Ampicillin/sulbactam 375mg PO q12h<br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h<br><br>Duration: 5-7 days | **Penicillin allergy:**<br>Doxycycline 100mg PO q12h for 5-7 days<br><br>**<u>Pregnant patients with penicillin allergy:</u>**<br>Azithromycin 500mg PO q24h for 3 days | Consider antibiotic if present at least 3 of below:<br>- Purulent/ greenish nasal discharge<br>- Severe local pain (VAS 8-10)<br>- Fever<br>- Elevated ESR/CRP |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | If no improvement after 3 days of oral antibiotics, refer to ENT. | | - Double sickening (becoming worse after initial recovery)<br>VAS: Visual Analogue Score |
| **Chronic Rhinosinusitis (CRS)**<br>**(with or without nasal polyps)**<br>*Staphylococcus aureus*<br>*Enterobacterales* spp<br>*Pseudomonas spp* | There is limited evidence that antibiotics, as a single therapy, are beneficial in the treatment of CRS.<br><br>For most patients, antibiotics represent one component of comprehensive medical management. It is important to note that antibiotics should be used **only** in patients who meet the diagnostic criteria for CRS.<br><br>In refractory patients, some suggest a 2-weeks course (may up to 6 weeks in selected patients) of macrolide therapy. The data are mixed and the potential for adverse effects may outweigh any potential benefit:<br>Clarithromycin 500mg PO q24h for 2 weeks, then 250mg PO q24h (up to 6 weeks in selected patients) | | Randomised controlled trials on the efficacy of long-term antibiotics in large and well defined populations with CRS are lacking<br><br>A more likely patient to respond has signs and symptoms dominated by a neutrophilic inflammation such as purulence, normal IgE and a low CT score.<br><br>As a precaution, macrolides should be avoided in patients with a long QT interval. |
| **4. Otology** | | | |
| **Acute otitis media (AOM)**<br>*Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis* | Amoxicillin/clavulanate 625mg PO q8h for 5 days | **Penicillin Allergy:**<br>Azithromycin 500mg PO on day 1, followed by 250mg PO q24h until day 5 | If symptoms not resolving after 48-72 hours, refer ENT |
| **Malignant Otitis Externa/ Necrotizing Otitis Externa**<br>*Pseudomonas aeruginosa* | Ciprofloxacin 400mg IV q8h for 2 weeks<br>**OR**<br>Ceftazidime 2g IV q8h for 2 weeks | | Prolong treatment of malignant otitis externa for 6-8 weeks is generally recommended, as indicated for osteomyelitis. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | followed by (once showing clinical response, consider switching to oral therapy):<br><br>Ciprofloxacin 750mg PO q12h for 6 weeks | | |
| **Acute Diffuse Otitis Externa**<br>*Pseudomonas aeruginosa*<br>*Staphylococcus aureus* | Ofloxacin 0.3% otic solution<br>Instil 10 drops into affected ear(s) q24h for 7 days | Hydrocortisone 10mg, neomycin 3.5mg, polymyxin B 10,000U per ml ear drops<br>Instil 3-4 drops into affected ear(s) q6-8h for max 10 days | Aural toileting required in discharging ears<br><br>Not to use ear drop in perforated ear drum |
| **Chronic Suppurative Otitis Media**<br>*P. aeruginosa*<br>*Staphylococcus aureus* | Ofloxacin 0.3% otic solution<br>Instil 10 drops into affected ear(s) q12h for 10-14 days | | |
| **Otomycosis**<br>*Aspergillus* sp. | Clotrimazole 1% ear solution, applied q12h for 10-14 days | | Aural toileting required.<br><br>Not to use ear drop in perforated ear drum |

**References:**


1. Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by Infectious Diseases Society of America, Clin Infect Dis 2012:55:86-102
2. Use of Diphtheria Antitoxin (DAT) for Suspected Diphtheria Cases, CDC 2016
3. Fokkens WJ, Lund VJ, Mullol J et al. EPOS 2012. European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryngologists. Rhinology 2012 Mar; 50(1): 1
4. Sore Throat (Acute): Antimicrobial Prescribing (NG84), NICE 2018
5. Stanford T. Shulman, Alan L. Bisno, Herbett W. Clegg, Michael A. Gerber, Edward L. Kaplan, Grace Lee. et al. Clinical Practice Guidelines for the
6. Grandis JR. Malignant (necrotizing) external otitis. Uptodate assessed 13/10/22

## RESPIRATORY INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **LOWER RESPIRATORY TRACT INFECTIONS** | | | |
| **1. Community-acquired Pneumonia** | | | |
| - The diagnosis of CAP generally requires the demonstration of an infiltrate on chest radiograph in a patient with a clinically compatible syndrome (eg. Fever, dyspnoea, cough and sputum production)<br>- CURB-65 is a clinical prediction rule that has been validated for predicting mortality in CAP.<br>i. Confusion<br>ii. BUN > 7 mmol/l<br>iii. Respiratory rate ≥30 BPM<br>iv. Blood pressure ≤90/60 mmHg<br>v. Age ≥65<br>- Score 0-1: Manage outpatient (unless patient has co-morbidity or has difficult social circumstances)<br>- Score 2 and above: Consider admission<br>- Physicians should use CURB-65 prediction tools to support, not replace clinical judgments. | | | |
| i. Outpatient | Amoxicillin 500mg PO q8h for 5-7 days | Amoxicillin/clavulanate 625mg PO q8h for 5-7 days<br>**OR**<br>Doxycycline 100mg PO q12h for 1 week | |
| ii. Inpatient (CURB ≥ 2) | Amoxicillin/clavulanate 1.2g IV q8h for 5-7 days<br>**PLUS**<br>Azithromycin 500mg IV/PO q24h for 3-5 days | Ceftriaxone 2g IV q24h for 5-7 days<br>**PLUS**<br>Azithromycin 500 mg IV/PO q24h for 3-5 days<br><br>**<u>Penicillin Allergy</u>** | *Levofloxacin should be strictly reserved for penicillin allergy due to higher risk of adverse events.<br><br>To switch to oral therapy when clinical condition improves and patient is able to tolerate orally. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | *Levofloxacin 500-750 mg IV/PO q24h for 5-7 days | |
| **2. Viral Pneumonia** | | | |
| i. Influenza | Oseltamivir 75mg PO q12h for 5 days | | |
| ii. *Varicella zoster* | Acyclovir 10mg/kg IV q8h for 7 days | | |
| **3. Lung Abscess and Empyema** | | | |
| Empirical | Amoxicillin/clavulanate 1.2g IV q6-8h | Ceftriaxone 2g IV q24h<br>**PLUS**<br>*Metronidazole 500 mg IV q8h<br><br>**<u>Penicillin Allergy</u>**<br>Clindamycin 600 mg IV/PO q6H | Duration of treatment:<br>-Drained abscess/empyema may require 2-4 weeks of antibiotics<br>-Undrained abscess/empyema may require 4-6 weeks of antibiotics<br><br>Lung empyema: Attempts should be made to drain the collection<br>May change to oral regime once clinical improvement seen<br><br>*Metronidazole: in cases of lung abscess when aspiration is suspected. |
| *Staphylococcus aureus* | Cloxacillin 2g IV q4-6h | Cefazolin 2g IV q8h | Duration: 4-6 weeks, depending on clinical response. In rare cases (slow response to antibiotics) may need prolonged therapy. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | May change to oral therapy (e.g. Amoxicillin/clavulanate 625mg PO q8h) to complete the duration once patient stabilised and improved |
| **4. Infective Exacerbation of Chronic Obstructive Pulmonary Disease (COPD)** | | | |
| Antibiotics only considered if there is increased purulence in sputum **AND** one of the following:<br>- Increased sputum volume<br>- Increased dyspnoea<br>**OR**<br>Patient intubated | | | |
| Outpatient | Amoxicillin/clavulanate 625mg PO q8h for 5-7 days | Cefuroxime 500mg PO q12h for 5-7 days<br>**OR**<br>Doxycycline 100mg PO q12h for 5-7 days | |
| Inpatient | Amoxicillin/clavulanate 1.2g IV q8h for 5-7 days<br>**PLUS/MINUS**<br>Azithromycin 500mg IV/PO q24h for 3-5 days | Ceftriaxone 2g IV q24h for 5-7 days<br>**PLUS/MINUS**<br>Azithromycin 500 mg IV/PO q24h for 3-5 days | |
| *If suspect *Pseudomonas* infection | **Piperacillin/tazobactam 4.5g IV q6-8h<br>**OR**<br>Cefepime 2g IV q8h<br><br>**PLUS/MINUS**<br>Azithromycin 500 mg IV/PO q24h for 3-5 day | Ceftazidime 2g IV q8h<br>**PLUS/MINUS**<br>Azithromycin 500 mg IV/PO q24h for 3-5 day | **Pseudomonas* sp risk factors:<br>1. Frequent exacerbation<br>2. Severe airflow limitation<br>3. Exacerbation requiring mechanical ventilation |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | **Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **5. Hospital-acquired Pneumonia (HAP/VAP)** | | | |
| Risk factors for multidrug resistance (MDR) organisms:<br>1. Prior intravenous antibiotic use within 90 days<br>2. More than 5 days of hospitalization in high risk ward (ICU, HDU)<br>3. Previous colonization with MDR pathogens<br>Risk of MDR organisms is lower with early onset HAP/VAP. | | | |
| **Early Onset HAP/VAP**<br>(2-4 days of admission/intubation) | Amoxicillin/clavulanate 1.2g IV q8h for 5-7 days | Ceftriaxone 2g IV q24h for 5-7 days | Need to adjust to local antibiogram/ prevalent organisms |
| **Late Onset HAP/VAP**<br>(5 days or more of admission/ intubation)<br>Causative organisms are determined by local prevalence. | *Piperacillin/tazobactam 4.5g IV q6-8h for 7 days<br>**OR**<br>Cefepime 2g IV q8h for 7 days | Imipenem/cilastatin 500mg IV q6h for 7 days<br>**OR**<br>Meropenem 1g IV q8h for 7 days | Ideal empirical antibiotic coverage depends on local prevalence of organisms.<br><br>Duration of antibiotics could be shortened to 7 days even for MDR *Pseudomonas aeruginosa* and *Acinetobacter baumannii* infections. Longer duration may be indicated depending upon clinical, radiological and laboratory parameters.<br><br>To de-escalate antibiotics according to culture and sensitivity results. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | *Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **6. Aspiration Pneumonia** | | | |
| | Amoxicillin/clavulanate 1.2g IV q8h | Ceftriaxone 2g IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Duration: 7- 10 days<br>To switch to oral therapy when clinical condition improves and patient is able to tolerate orally.<br><br>Antibiotics are not indicated for aspiration (chemical) pneumonitis. |

**References:**

1. National Antimicrobial Guideline 2019.

## SEXUALLY TRANSMITTED INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Syphilis (*Treponema pallidum* Infection)** | | | |
| **Early Syphilis (< 2 years)**<br>● Primary Syphilis<br>● Secondary Syphilis<br>● Early Latent Syphilis<br>(History of syphilis infection in the last 2 years) | Benzathine Penicillin 2.4MU IM stat<br>**OR**<br>Procaine Penicillin G 600,000units IM q24h for 10 days | **Penicillin Allergy:**<br>Ceftriaxone 1g IM/IV q24h for 10 days (if no anaphylaxis to penicillin)<br>**OR**<br>Doxycycline 100mg PO q12h for 14 days | If drug administration is interrupted for ≥ 1 day at any point during the treatment course, it is recommended that the entire course is restarted.<br><br>Contact tracing:<br>Examine and investigate sex partner and treat when indicated<br><br>Follow up:<br>Clinical and serologic evaluation should be performed at 6 and 12 months after treatment; more frequent evaluation might be prudent if opportunity for follow-up is uncertain or if repeat infection is a clinical concern.<br><br>Jarisch-Herxheimer reaction: To treat with Paracetamol |
| **Late Syphilis (> 2 years)**<br>● Late Latent Syphilis<br>● Tertiary syphilis (Gumma)<br>● *Cardiovascular syphilis | Benzathine Penicillin 2.4MU IM weekly for 3 weeks (Day 1, 8 & 15)<br>**OR**<br>Procaine Penicillin G 600,000units IM q24h for 14 days | **Penicillin Allergy:**<br>Doxycycline 100mg PO q12h for 28 days | Contact tracing:<br>Examine and investigate sex partner and treat when indicated<br><br>Follow up:<br>6 monthly for 2 years and yearly until RPR negative or stable at a low titre RPR 1:4 or less |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | If a patient defaults Benzathine Penicillin treatment by ≥ two weeks in between the weekly doses, the whole regime need to be restarted.<br><br>*For cardiovascular syphilis:<br>Consider Prednisolone 40-60mg PO q24h for 3 days commencing 24h before the antibiotics. |
| **Neurosyphilis** | Benzylpenicillin 4MU q4h IV for 10-14 days<br>**OR**<br><br>Procaine penicillin G 2.4MU IM q24h<br>**PLUS**<br>Probenecid 500mg PO q6h<br>(both for 10–14 days) | **Penicillin Allergy:**<br>Doxycycline 200mg PO q12h for 28 days<br>**OR**<br>Ceftriaxone 2g IM q24h (lidocaine as diluent) for 10-14 days (if no anaphylaxis to penicillin)<br>**OR**<br>Ceftriaxone 2g IV q24h (WFI as diluent) for 10-14 days (if no anaphylaxis to penicillin) | Contact tracing:<br>Examine and investigate sex partner and treat when indicated<br><br>CSF examination should be done in<br>1. Patients with neurological and/or ocular symptoms or signs.<br>2. Nontreponemal test titres do not decrease by fourfold within 12 months of therapy<br><br>All persons who have neurosyphilis, ocular syphilis, or otosyphilis should be tested for HIV at the time of diagnosis.<br><br>Consider corticosteroid cover to prevent the Jarisch-Herxheimer reaction:<br>Prednisolone 40-60mg PO q24h for 3 days commencing one day prior to syphilis treatment |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Syphilis in HIV**<br>Primary, secondary, early and late latent, neurosyphilis, and of unknown duration | Treat as appropriate stage for infection | | CSF examination should be done and repeat at 3, 6, 9, 12 and 24 months after therapy to detect any treatment failure (not reduced by 4-fold within 1 year).<br><br>Perform full neurological examination. |
| **Syphilis in Pregnancy**<br>(primary, secondary, early latent) | **First and second trimester**:<br>Benzathine Penicillin 2.4MU IM stat<br><br>**Third trimester**:<br>Benzathine Penicillin 2.4MU IM weekly for 2 weeks (Day 1 & 8)<br><br>**OR**<br><br>**(ALL THREE TRIMESTERS)**<br>Procaine penicillin G 600,000units IM q24h for 10 days | **Penicillin Allergy:**<br>(All three trimesters)<br><br>Ceftriaxone 500mg IM q24h for 10 days<br>**OR**<br>Azithromycin 500mg PO q24h for 10 days<br>**OR**<br>*Erythromycin Ethylsuccinate 800mg PO q6h for 14 days | Tetracycline & Doxycycline are contraindicated in pregnancy<br><br>*If macrolide therapy, neonate require assessment and treatment at birth by Paediatrician<br><br>Pregnant ladies with syphilis and history of penicillin allergy to be desensitised only in tertiary centres.<br><br>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. |
| **Syphilis in Pregnancy**<br>(Late latent, gummatous, cardiovascular, neurosyphilis) | Treat as for non-pregnant patients<br>(**DO NOT USE DOXYCYCLINE** in pregnancy) | | |
| **Gonorrhoea (*Neisseria gonorrhoeae* Infection)** | | | |
| **Uncomplicated**<br>(anogenital, pharyngeal gonorrhoea) | Ceftriaxone 500mg IM stat<br>P**LUS**<br>*Azithromycin 1g PO stat | **Beta-lactam Allergy:**<br>Gentamicin 240mg IM stat<br>**PLUS**<br>*Azithromycin 2g PO stat | Contact tracing<br>Sexual partners should be treated for gonorrhoea even though they are asymptomatic. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | **<u>Pregnancy & breastfeeding:</u>**<br>Ceftriaxone 500mg IM stat<br>**PLUS**<br>*Azithromycin 1g PO stat | *Azithromycin: Dual therapy to treat for coexisting *Chlamydia trachomatis* infection (35-40%), synergistic effect and reduce cephalosporin resistance. |
| **Gonococcal Conjunctivitis** | Ceftraxone 1g IM stat | **Anaphylaxis to Penicillin or established allergy to Cephalosporin:**<br>Azithromycin 2g PO stat<br>**PLUS**<br>Doxycycline 100mg PO q12h for 7 days<br>**PLUS**<br>Ciprofloxacin 250mg PO q24h for 3 days | |
| **Disseminated Gonorrhoea** | Ceftriaxone 1-2g IM/IV q24h for 7 days | Cefotaxime 1g IV q8h for 7 days | When treating for the arthritis-dermatitis syndrome, the provider can switch to an oral agent guided by antimicrobial susceptibility testing 24–48 hours after substantial clinical improvement, for a total treatment course of >7 days.<br><br>Length of treatment should be determined based on clinical presentation.<br><br>May be switched to Ciprofloxacin 500mg PO q12h 24-48hrs after symptoms improve. |
| **Gonococcal Epididymitis/ Epididymo-orchitis**<br><br>Caused by gonorrhoea and chlamydia | Ceftriaxone 500mg IM stat<br>**PLUS**<br>Azithromycin 1g PO stat | | Contact tracing |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| STI related but unlikely gonorrhoea<br><br>Non-STI related (Enteric organisms) | **PLUS**<br>Doxycycline 100mg PO q12h for 14 days<br><br>Doxycycline 100mg PO q12h for 14 days<br><br>Ciprofloxacin 500mg PO q12h for 10 days | | |
| **Gonococcal Meningitis** | Ceftriaxone 2g IV q12h for 10- 14 days | | |
| **Gonococcal Endocarditis** | Ceftriaxone 2g IV q24h | | Parenteral antimicrobial therapy for endocarditis should be administered for >4 weeks. |
| **Chlamydia Infections (*Chlamydia trachomatis*)** | | | |
| **Uncomplicated**<br>● Non-specific Urethritis<br>● Non-specific Genital Tract Infection | Doxycycline 100mg PO q12h for 7 days | Azithromycin 1g PO stat, then 500mg PO q24h for 2 days | Contact tracing |
| **Chlamydia in Pregnancy**<br>● Non-specific Urethritis<br>● Non-specific Genital Tract Infection | Azithromycin 1g PO stat, then 500mg PO q24h for 2 days | Amoxicillin 500mg PO q8h for 7 days<br>**OR**<br>Erythromycin Ethylsuccinate 800mg PO q6h for 7 days | Doxycycline is contraindicated in pregnancy |
| **Non-Gonococcal Urethritis (NGU)** | | | |
| **First episode** | Doxycycline 100mg PO q12h for 7 days | Azithromycin 500mg PO stat then 250mg q24h for 4 days | |
| **Recurrent and persistent**<br><br>If treated with doxycycline first line | Azithromycin 500mg PO stat, then 250mg PO for 4 days<br>**PLUS**<br>Metronidazole 400mg PO q12h for 5 days | | Most common cause:<br>*Mycoplasma genitalium* |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| If treated with azithromycin first line | Moxifloxacin 400mg PO q12h for 10-14 days<br>**PLUS**<br>Metronidazole 400mg PO q24h for 5 days | | |
| **Herpes Simplex Virus Type-1 and 2 (HSV-1 & 2) Infections** | | | |
| **Herpes Genitalis** | | | |
| First episode: | Acyclovir 400mg PO q8h for 7-10 days | *Valaciclovir 1g PO q12h day for 7-10 days | Acyclovir 200 mg orally five times/day is also effective but is not recommended because of the frequency of dosing. (CDC) |
| Recurrent episodes: | **Short Course**<br>Acyclovir 800mg q8h PO for 2 days<br>**OR**<br>**5 days regime**<br>Acyclovir 400mg q8h PO for 5 days | *Valaciclovir 500mg PO q12h for 3-5 days | *Requires special medicine approval |
| Suppressive therapy:<br>(may be indicated if > 6 recurrences per year) | Acyclovir 400mg PO q12h | *Valaciclovir 500mg PO q24h | Duration up to one year, then reassess |
| **Herpes Genitalis in HIV** | | | |
| Primary: | **Acyclovir 400-800mg PO q8-12h for 5-10 days | *Valaciclovir 1gm PO q12h for 5- 10 days | *Requires special medicine approval |
| Severe: | Acyclovir 5-10mg/kg IV q8h for 2-7 days and then followed by Acyclovir PO (minimun 10 days) | | **Treatment courses might need to be extended for lesion resolution<br><br>Physical supportive measures: saline bathing, analgesic local anaesthetics and psychological support. |
| Recurrent: | Acyclovir 400mg PO q8h for 5–10 days | *Valaciclovir 1g PO q12h for 5–10 days | |
| Suppressive: | ***Acyclovir 400mg-800mg PO q8-12h | */***Valaciclovir 500mg PO q12h | Oral antiviral drugs indicated within 5 days of the start of the episode and while new lesions are still forming. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Topical antivirals are less effective than oral agents and not recommended, due to the association with acyclovir resistant strain.<br><br>Addition of topical antivirals to oral treatment is of no benefit<br><br>***Duration: All for up to 1 year, then reassess<br><br>If breakthrough recurrences occur, dosage should be increased (refer recurrent dose) |
| **Herpes Genitalis in pregnancy**<br><br>First episode<br><br><br><br><br><br><br>Suppressive therapy for recurrent infections | <br><br>**<u>First or second trimester</u> <u>acquisitions</u>**<br>Acyclovir 400mg PO q8h for 5 days<br><br>**<u>Third trimester (from 28 weeks)</u>**<br>Acyclovir 400mg PO q8h for 5 days<br><br><br>Acyclovir 400mg PO q8h<br>(Treatment recommended starting at 36 weeks of gestation until delivery) | <br><br><br>*Valaciclovir 500m PO q12h day for 5 days<br><br>*Valaciclovir 500mg PO q12h for 5 days | Do not delay treatment whilst awaiting results (HSV PCR recommended)<br><br>**<u>Third trimester acquisition:</u>**<br>-No additional monitoring of the pregnancy is required<br>-Continue daily suppressive Acyclovir 400 mg PO q8h until delivery<br><br>*Requires special medicine approval |
| **Other Sexually Transmitted Infections** | | | |
| **Chancroid**<br>*Haemophilus ducreyi* | Azithromycin 1g PO stat<br>**OR**<br>Ceftriaxone 250mg IM stat<br>**OR** | | *preferred in HIV positive patients, but not preferred in pregnant/lactating patients |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | *Ciprofloxacin 500mg q12h for 3 days | | Contact tracing<br><br>Sexual contacts within 10 days before onset of patient's symptoms should be examined and treated even in the absence of symptoms<br><br>Avoid unprotected sexual intercourse until they and their partner(s) have completed treatment and follow-up.<br><br>Patients should be re-examined 3 to 7 days after initiation of therapy. Successful therapy: ulcers improved symptomatically within 3 days and substantial re-epithelization within 7 days after onset of therapy |
| **Lymphogranuloma Venereum**<br>*Chlamydia trachomatis*<br>*Serovar L1, 2, 3* | Doxycycline 100mg PO q12h for 21 days | Azithromycin 1g PO weekly for 3 weeks | Contact tracing<br><br>Persons who have had sexual contact with a patient who has LGV within the 60 days before onset of the patient's symptoms should be evaluated, examined, and tested for chlamydial infection, depending on anatomic site of exposure.<br><br>Asymptomatic partners should be presumptively treated with a chlamydia regimen (doxycycline 100 mg orally 2 times/day for 7 days) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | All persons who have been treated for LGV should be retested for chlamydia approximately 3 months after treatment. If retesting at 3 months is not possible, providers should retest at the patient's next visit for medical care within the 12-month period after initial treatment. |
| **Granuloma Inguinale**<br>*Klebsiella granulomatis* | Azithromycin 1g PO weekly or 500mg PO q24h<br>**PLUS/MINUS**<br>Gentamicin 1mg/kg IV/IM q8h<br>(in patients whose lesion do not respond in the first few days to other agents) | Doxycycline 100mg PO q12h<br>**OR**<br>Trimethoprim/sulfamethoxazole 80/400mg 2 tabs PO q12h<br>**OR**<br>Ciprofloxacin 750 mg PO q12h<br><br>**PLUS/MINUS**<br>Gentamicin 1mg/kg IV/IM q8h<br>(in patients whose lesion 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 generally recommended<br><br>Contact tracing<br><br>In the absence of any reliable screening test and the long incubation period, all sexual contacts in the last 6 months should be examined for possible lesions by clinical examination. |
| **Trichomoniasis**<br>*Trichomonas vaginalis*<br><br>Treatment failure (second regimen): | Metronidazole 2g PO stat **OR** 400mg PO q12h for 5 days<br><br>Metronidazole 400mg PO q12h for 7 days | | Sexual contact(s) should be treated simultaneously and patients should be advised to abstain for at least one week until they and their partner(s) have completed treatment and follow-up.<br><br>Any partners within the 4 weeks prior to presentation should be screened |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | for the full range of STIs and treated for TV.<br><br>TOC is only recommended if the patient remains symptomatic following treatment, or if symptoms recur.<br><br>Higher-dose of metronidazole is required if failing the second regimen. |
| **Bacterial vaginosis**<br>*Gardnerella vaginalis,*<br>Anaerobes | Metronidazole 400mg PO q12h for 5-7 days **OR** 2g PO stat | Clindamycin 300mg PO q12h for 7 days | Not an STI but frequently detected during STI screening |

**Reference:**
1. MMWR Sexually Transmitted Infections Guidelines 2021, CDC
2. National Antimicrobial Guideline 2019.
3. Prevention, Diagnosis & Management Of Infective Endocarditis 2017

## SKIN AND SOFT TISSUE INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **PURULENT SKIN AND SOFT TISSUE INFECTION** | | | |
| **Localized Impetigo**<br>(*S. aureus, S. pyogenes)* | *Topical 2% fusidic acid q8-12h for 5 days (Outpatient use only)<br>**OR**<br>Cloxacillin 500-1000mg PO q6h for 5-7 days<br>**OR**<br>Cephalexin 250-500mg PO q6h for 5-7 days | | *Only can be used by Dermatologist |
| **Generalised Impetigo/Ecthyma** | Cephalexin 250-500mg PO q6h<br><br>**<u>Penicillin allergy:</u>**<br>Erythromycin Ethylsuccinate 800mg PO q12h | Amoxicillin/clavulanate 625mg PO q8h<br><br>**<u>Other alternative/ in case of CA-MRSA:</u>**<br>Clindamycin 600mg PO q8h<br>**OR**<br>Trimethoprim/sulfamethoxazole 160/800mg PO q12h | Duration : 5-7 days |
| **Ecthyma gangrenosum**<br>*Pseudomonas sp.* | Ciprofloxacin 500mg PO q12h<br>**OR**<br>*Piperacillin-Tazobactam 4.5g IV q6-8h | Ceftazidime 2gm IV q8h<br>**OR**<br>Cefepime 2gm IV q8h | Consider adding aminoglycoside in selected cases such as in immunocompromised/neutropenic and septic shock patients. Use synergistic combination therapy with aminoglycosides until susceptibilities are known. Antibiotics need to be tailored according to culture results. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | *Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **NON-PURULENT SKIN & SOFT TISSUE INFECTION** | | | |
| **Furuncles** | Cloxacillin 500mg PO q6h | Amoxicillin/clavulanate 625mg PO q8h | For 5-7 days |
| **Carbuncles**<br>*S. aureus* | Cloxacillin 1-2gm IV q6h | Amoxicillin/clavulanate 1.2gm IV q8h<br>**OR**<br>Cefazolin 1gm IV q8h | Surgical drainage is the mainstay of treatment.<br><br>Duration : 7-10 days |
| **Erysipelas**<br>*Strep. pyogenes* | Phenoxymethylpenicillin 500mg PO q6h<br>**OR**<br>Amoxicillin 500mg PO q8h<br><br>**<u>If severe:</u>**<br>Benzylpenicillin 2-4MU IV q4-6h | Cephalexin 500mg PO q6h<br><br>**<u>If severe:</u>**<br>Cefazolin 1gm IV q8h<br>**OR**<br>Cefuroxime 750mg IV q8h | Duration : 7-10 days |
| MRSA | Vancomycin 25mg/kg loading dose then 15-20mg/kg q8-12h; not to exceed 2gm/dose | | |
| **Diabetic Foot Infections** | Refer to Bone & Joint Infections Section | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Gas Gangrene/ Myonecrosis/ Necrotizing Fasciitis** | Refer to Bone & Joint Infections Section | | |
| **Yaws**<br>*Treponema pertenue* | Benzathine Penicillin 1.2 MU IM single dose | Doxycycline 100mg PO q12h for 15 days<br>**OR**<br>Azithromycin 30mg/kg (max 2g) single dose<br><br>**Penicillin Allergy:**<br>Erythromycin Ethylsuccinate 800mg PO q12h for 15 days | |
| **CELLULITIS** | | | |
| **Mild**<br>*Staph. aureus*<br>*Strep. Pyogenes* | Cephalexin 500mg PO q6h | Cefuroxime 250-500mg PO q12h<br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h | **Duration: 5-10 days according to clinical response**<br><br>Change to oral once the condition improved<br><br>Gram negative coverage may be necessary in the following circumstances:<br>1. Potential relation of the cellulitis to a decubitus ulcer<br>2. Crepitant cellulitis<br>3. Prominent skin necrosis/ gangrene<br>4. Location (perioral/perirectal cellulitis) |
| **Moderate**<br>*Staph. aureus*<br>*Strep. Pyogenes* | Cloxacillin 1-2gm IV q6h | Cefazolin 1-2gm IV q8h | |
| **Severe**<br>*Staph. aureus*<br>*Strep. Pyogenes* | Ampicillin/sulbactam 3gm IV q6-8h<br>**PLUS/MINUS**<br>Clindamycin 600mg IV q6h<br>(Deescalate once cultures are available/ Necrotizing fasciitis ruled out) | *Piperacillin/tazobactam 4.5gm IV q6-8h<br>**PLUS/MINUS**<br>Clindamycin 600mg IV q6h<br>(Deescalate once cultures are available/ Necrotizing fasciitis ruled out) | |
| ****Consider alternative organisms in the following circumstances:** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Dog/cat bite**<br>*Pasteurella multocida*<br>*Capnocytophaga canimorsus* | Amoxicillin/clavulanate 625mg PO q8h | | 5. Clinical condition: (Septicaemic shock/Suspecting necrotizing fasciitis)<br>6. Immunocompromised patients<br>7. Specific exposures**<br><br>*Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours)<br><br>***Consider adding 3rd-generation Cephalosporin in severe infections |
| **Cat scratch disease**<br>*Bartonella henselae* | Azithromycin 500mg PO on Day 1, then 250mg PO q24h for 4 days | | |
| **Human bite**<br>*Eikenella corrodens*<br>*Anaerobes*<br>*Staph. aureus* | Amoxicillin/clavulanate 625mg PO q8h | | |
| **Salt water exposure**<br>*Vibrio sp.* | Doxycycline 200mg stat then 100mg PO q12h<br>**PLUS/MINUS**<br>***Ceftriaxone 2gm IV q24h | | |
| **Fresh or brackish water exposure**<br>*Aeromonas sp.*<br>*Plesiomonas* | Ciprofloxacin 400mg IV q12h<br>**OR**<br>Ciprofloxacin 750mg PO q12h | | |
| **Neutropenic patients**<br>*Pseudomonas aeruginosa*<br>other Gram negatives | *Piperacillin/tazobactam 4.5gm IV q6-8h | Ceftazidime 2gm IV q8h<br>**OR**<br>Cefepime 2gm IV q8h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **MRSA** | Vancomycin 25mg/kg loading dose then 15-20mg/kg IV q8-12h<br><br>**In severe infections:**<br>To load with Vancomycin 25-30mg/kg IV, followed by 15-20mg/kg (actual body weight) IV q8-12h; not exceeding 2g/dose | Linezolid 600mg IV/PO q12h | |
| ****** If CA-MRSA suspected** | Clindamycin 300-450mg IV/PO q8h<br>**OR**<br>Doxycycline 100mg PO q12h<br>**OR**<br>Trimethoprim/sulfamethoxazole 160/800mg PO q12h | | ****Consider CA-MRSA if :<br>1. Outbreaks of known CA-MRSA<br>2. If non-resolving cellulitis |
| **PERIPHERAL PHLEBITIS/THROMBOPHLEBITIS** | | | |
| *Staphylococcus aureus*<br>*Coagulase negative Staphylococcus*<br>*Gram negative rods* | **Early stage phlebitis:**<br>Remove the intravenous cannula<br><br>**Medium and advanced stage phlebitis or thrombophlebitis:**<br>Remove the intravenous cannula and take blood culture<br><br>Can consider empirical treatment if persistent fever:<br><br>Cephalexin 500mg PO q6h<br>**OR**<br>Cloxacillin 1-2gm IV q6h | | Peripheral intravenous catheters with associated pain, induration, erythema, or exudate should be removed. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **BED SORE/PRESSURE SORE/DECUBITUS ULCER** | | | |
| | Local treatment is preferred.<br><br>**If there is surrounding cellulitis/signs of bacteremia/fasciitis/surrounding intramuscular abscess/OM changes:**<br>Ampicillin/sulbactam 3gm IV q6-8h | | |
| **MYCOBACTERIAL INFECTIONS** | | | |
| **Hansen's Disease (Leprosy)**<br>*Mycobacterium Leprae* | **Paucibacillary**<br>Rifampicin 600mg PO monthly<br>**PLUS**<br>Dapsone 100mg PO q24h<br><br>Duration: 6 months<br>(Completion of 6 doses within 9 months)<br>Surveillance: 5 years<br><br>**Multibacillary**<br>Rifampicin 600mg PO monthly<br>**PLUS**<br>Clofazimine 300mg PO monthly and 50-100mg PO q24h | **<u>*Bacterial resistance or hypersensitivity to first line</u>**<br>Can be substituted with one of the following:<br>Minocycline 100mg PO q24h<br>**OR**<br>Ofloxacin 400mg PO q24h<br>**OR**<br>Clarithromycin 500mg PO q24h<br>**OR**<br>Ethionamide 250mg PO q24h | *Second line can only be initiated by a dermatologist |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **PLUS**<br>Dapsone 100mg PO q24h<br><br>Duration: 1 year (if initial BI<4) or 2 years (if BI≥4)<br>Completion of 12 doses within 18 months (BI<4)<br>Completion of 18 doses within 36 months ( BI≥4)<br>Surveillance: 15 years | | |
| **Hansen's Disease (Leprosy) in HIV** | Same as non HIV patients | | |
| **NON-TUBERCULOUS MYCOBACTERIAL INFECTIONS** | | | |
| *Mycobacterium marinum* | Clarithromycin 500mg PO q12h<br>**PLUS**<br>Minocycline/Doxycycline 100mg PO q12h<br><br>At least 2 months of treatment until clearance | Rifampicin 600mg PO q24h<br>**PLUS**<br>Ethambutol 15mg/kg PO q24h for 4-6 months, and continue for at least 1 month after lesions have been cleared<br><br>**OR**<br>Doxycycline 100mg q12h for 1-2 months after lesion clearance (3-4 months) | Often resistant to isoniazid |
| *Mycobacterium kansasii* | Isoniazid 300mg PO q24h<br>**PLUS**<br>Rifampicin 600mg PO q24h<br>**PLUS**<br>Ethambutol 15mg/kg PO q24h | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Duration: 18 months | | |
| *Mycobacterium ulcerans*<br>(Buruli ulcer) | Rifampicin 10mg/kg PO q24h<br>**PLUS**<br>Streptomycin 15mg/kg IM q24h<br><br>Duration: 8 weeks | Rifampicin 10mg/kg PO q24h<br>**PLUS**<br>Streptomycin 15mg/kg IM q24h<br><br>Duration: 4 weeks<br><br>**Followed by**<br>Rifampicin 10mg/kg PO q24h<br>**PLUS**<br>Clarithromycin 7.5mg/kg PO q12h<br><br>Duration: 4 weeks<br>(Total duration of 8 weeks) | Wide surgical excision and debridement are important. |
| *Mycobacterium fortuitum/ chelonei* | **Combination therapy (2 of the following):**<br>Clarithromycin 500mg PO q12h<br>**OR**<br>Doxycycline/Minocycline 100mg PO q12h<br>**OR**<br>Ciprofloxacin 500-750mg PO q12h<br><br>**PLUS/MINUS**<br>*Amikacin 15mg/kg IV q24h | | *Amikacin: Started for severe infection until clinical improvement (together with 2 oral agents), then continue with just 2 oral agents. |
| **FUNGAL INFECTIONS** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Tinea capitis**<br>*Trichophyton*<br>*Microsporum* | Griseofulvin 500mg q12h for 6 to 12 weeks or longer till fungal cultures are negative<br>**OR**<br>Terbinafine 250mg PO q24h<br><br>**PLUS**<br><br>2.5% Selenium sulphide shampoo<br>**OR**<br>2% ketoconazole shampoo, 2 – 3 times per week for 2 weeks | Itraconazole 200mg PO q24h<br>**OR**<br>Fluconazole 6mg/kg PO q24h<br><br>Duration is based on mycological agent:<br>-*Trichophyton* spp : 2-4 weeks<br>-*Microsporum* spp : 8-12 weeks | **Other recommendations:**<br>1)Kerion: Griseofulvin should be considered as the first line unless *Trichophyton* has been cultured as the pathogen. Duration of treatment may be longer.<br>2) Contacts of patient may be treated with 2% ketoconazole shampoo 2 – 3 times per week for 2 weeks.<br>3) Surgical excision is to be avoided<br>4)Topical therapy alone is not recommended for the management of tinea capitis.<br>5)Consider adding oral prednisolone in selected cases. |
| **Tinea barbae** | Same as treatment of **Tinea capitis** | | |
| **Tinea corporis /Tinea cruris/Tinea faciei**<br>*Trichophyton*<br>*Microsporum,*<br>*Epidermophyton* | **Mild Infections:**<br>Topical imidazoles/allylamines cream/lotion:<br>Clotrimazole 1%<br>**OR**<br>Miconazole 2%<br>**OR**<br>Ketoconazole<br>**OR**<br>Terbinafine<br><br>Duration: till clinical clearance with additional 2 weeks | | **Recommendations:**<br>1. In patients with renal or hepatic impairment, caution should be exercised while prescribing systemic antifungals.<br>2. Terbinafine clearance significantly reduced in patients with renal impairment. Other systemic antifungals are preferred in these patients.<br>3. Topical Nystatin should not be used in dermatophytosis as they are not effective against dermatophytes |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | **Extensive infections:**<br>Terbinafine 250mg PO q24h for 2 weeks<br>**OR**<br>Itraconazole 200mg PO q24h for 2 weeks<br>**OR**<br>Griseofulvin 500mg PO q12h or q24h for 4-6 weeks | Fluconazole 200-300mg per week PO for 3-4 weeks | |
| **Tinea manuum/ Tinea pedis**<br>*Trichophyton, Microsporum, Epidermophyton* | **First line:**<br>Topical antifungals as mentioned in tinea corporis for 4-8 weeks<br><br>**Resistant cases:**<br>Terbinafine 250mg PO q24h for 2-4 weeks<br>**OR**<br>Itraconazole 200mg PO q24h for 2-4 weeks<br>**OR**<br>Griseofulvin 500mg PO q12h for 6-12 weeks | Fluconazole 200mg/week PO for 4 weeks | **Recommendations:**<br>1. Topical keratolytic agents can be used in conjunction with antifungals for hyperkeratotic type of tinea pedis/manuum.<br>2. KMnO4 in 1:10,000 dilution wet dressings, applied for 20 min 2-3 times/day, may be helpful if vesiculation or maceration is present.<br>3. Systemic antifungals can be prescribed as first line treatment in severe moccasin-type tinea pedis or severe recurrent tinea with blisters. |
| **Tinea unguium**<br>*Trichophyton, Microsporum, Epidermophyton* | Amorolfine 5% Nail Lacquer weekly application<br>**Duration:**<br>For 6 months (fingernails)<br>For 12 months (toenails)<br><br>**OR** | Griseofulvin 500mg PO q12h<br>**Duration:**<br>For 6 months (fingernails)<br>For 12 months (toenails)<br><br>**OR**<br>Fluconazole 200mg PO once weekly<br>**Duration:** | Amorolfine 5% Nail Lacquer is not indicated for children less than 12 years old.<br><br>Patients with contraindications to systemic agents may consider topical antifungal agents. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Pulse Itraconazole 200mg PO q12h for 1 week per month<br>**Duration:**<br>For 2 months (fingernails)<br>For 3 months (toenails)<br><br>**OR**<br>Terbinafine 250mg PO q24h<br>**Duration:**<br>For 6 weeks (fingernails)<br>For 12 weeks (toenails) | For ≥ 3 months (fingernails)<br>For 6-12 months (toenails) | Diagnosis of onychomycosis should be confirmed with a KOH preparation, culture, or PAS Stain. Empirical treatment is not recommended. |
| **Tinea versicolor**<br>*Malassezia Furfur*<br>*Pityrosporum Orbiculare* | **First line:** Topical treatment only<br><br>Selenium Sulphide 2% Shampoo<br>Apply to affected areas 10 minutes before bathing **OR** dilute to 1:1 with water, apply and leave overnight (treat for 1-2 weeks)<br><br>**OR**<br>2% Ketoconazole shampoo apply to affected areas 10 minutes before bathing<br><br>**<u>For face:</u>**<br>Topical Imidazole for 4-6 weeks e.g:<br>Miconazole 2% cream<br>**OR**<br>Clotrimazole 1% cream<br><br>**For recurrent or resistant cases:**<br>Itraconazole 200mg PO q24h for 1 week | Sulfur<br>**PLUS**<br>salicylic solution | **Recommendations:**<br>Ketoconazole shampoo or Selenium sulphide shampoo to be used once every two to four weeks for approximately six months in order to try and prevent recurrence. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **OR**<br>Fluconazole 200-300mg PO weekly dose for 2 to 4 weeks | | |
| **Candidiasis**<br>*Candida albicans* | **Mild cutaneous candidiasis:**<br>Topical Imidazole q12h till clear e.g, Miconazole 2% cream<br>**OR**<br>Clotrimazole 1% cream | | Treatment of sexual partners is advisable in case of recurrent infection.<br><br>*Itraconazole: Absorption depends on gut acidity. Take capsule with food and acidic beverage (e.g.: Cola drinks). Avoid PPIs and H2 blockers. |
| | **Extensive cutaneous candidiasis:**<br>*Itraconazole 200mg PO q24h for 1 week | **In severe and immunocompromised patients:**<br>Fluconazole 100mg PO q24h for 1 week | |
| **Subcutaneous Fungal Infections**<br>Lymphocutaneous and Cutaneous Sporotrichosis | *Itraconazole 200mg PO 12h until all lesions have resolved (usually for a total of 3-6 months) | **For patients not able to tolerate Itraconazole:**<br>Terbinafine 250mg PO q12h<br>**OR**<br>Fluconazole 400-800mg q24h | In some immunocompromised condition such as AIDS, longer treatment may be necessary. Refer to Opportunistic Infections in HIV Patients<br><br>*Itraconazole: Absorption depends on gut acidity. Take capsule with food and acidic beverage (e.g.: Cola drinks). Avoid PPIs and H2 blockers. |
| **Systemic sporotrichosis** (pulmonary osteoarticular, meningeal, or disseminated sporotrichosis) | Amphotericin B deoxycholate 0.7-1mg/kg q24h for 2 weeks followed by *Itraconazole 200mg PO q12-24h for 12 months | | |
| **Sporotrichosis In Pregnancy*** | Terbinafine 250mg PO q24h | Amphotericin B deoxycholate 0.7-1mg/kg q24h | *Avoid azole in pregnancy. |
| **Cutaneous fungal infection in immunocompromised patients** | Refer to treatment of disseminated fungal infection in immunocompromised/HIV patients | | Skin biopsy for HPE and culture are advised before commencing treatment. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| ***Aspergillus* sp, *Scedosporium apiospermum*, and *Fusarium* sp. infection** | Voriconazole 6mg/kg IV q12h for 2 doses, followed by 4mg/kg IV q12h | Amphotericin B deoxycholate 0.7-1mg/kg q24h<br>**OR**<br>*Amphotericin B lipid formulation 3-5mg/kg q24h | *Only by ID prescriber |
| **Cryptococcal infections**<br>**1.Mild**<br><br>**2.Life threatening** | Fluconazole 100mg-400mg PO q24h<br><br>Refer to Treatment of disseminated fungal infection in Immunocompromised/HIV patients | | |
| **Penicilliosis and life threatening acute severe disseminated Histoplasmosis** | Refer to Treatment of disseminated fungal infection in immunocompromised/HIV patients | | |
| **VIRAL INFECTIONS** | | | |
| **Herpes Simplex Infections** | **i) Mild infection:**<br>Acyclovir 400mg PO q8h for 5 days<br><br>**ii) Severe life threatening:**<br>Acyclovir 5-10mg/kg IV q8h for 5 days or until able to take orally, then change to oral<br><br>**iii) Genitalia:**<br>Refer to Sexually Transmitted Infections section | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Chickenpox (Varicella Zoster)** | **i) Immunocompetent**<br>Acyclovir 800mg PO 5 times daily for 7 days<br><br>**ii) Immunocompromised**<br>Acyclovir 10mg/kg IV q8h for 7 days (change to oral once there is an improvement) | | Advisable to start treatment early within 48 hours. |
| **Herpes Zoster** | Refer to varicella zoster treatment above | | Topical antiviral treatment is not recommended for Herpes Zoster.<br><br>Systemic antiviral treatment is recommended for all immunocompromised patients or for immunocompetent patients with following criteria:<br>(1) >50 years of age<br>(2) have moderate or severe pain<br>(3) have moderate or severe rash<br>(4) have non-truncal involvement<br><br>Advisable to start treatment early within 48-72 hours |
| **PARASITIC INFESTATION** | | | |
| **Scabies**<br>*Sarcoptes scabiei* | Benzyl Benzoate emulsion 25% (EBB) apply from neck down and leave for 24 hours for 2-3 days<br>**OR** | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | Permethrin 5% lotion/cream apply and leave for 8 hours<br>Repeat application after 1 week<br><br>**In pregnancy/ Immunocompromised:**<br>Permethrin 5% lotion/cream apply and leave for 8 hours<br>Repeat application after 1 week | | |
| **Head Lice**<br>*Pediculus humanus capitis* | Permethrin 1% lotion apply to scalp for 10 min and wash off | | |
| **Body Lice/pubic Lice**<br>*Pediculus humanus* | Permethrin 1% cream apply to affected area for 10 min and wash off | | |

**References:**


1. Stevens et al. Clinical Infectious Diseases 2014;59(2)
2. Sarkar S et al. Indian Dermatol Online J 2016; 7:36.
3. Reich HL et.al. J Am Acad Dermatol. 2004;50
4. Morton N Swartz. N Engl J Med 2004; 350:904-12.
5. CREST guidelines. 2005
6. Begier EM et al. Clin Infect Dis 2004; 39:1446.
7. Malaysian Clinical practice Guideline on Management of leprosy 2014
8. Primary Care Dermatology Society UK 2013
9. L.C. Fuller,1 R.C. Barton,2 M.F. Mohd Mustapa,3 L.E. Proudfoot,4 S.P. Punjabi5 and E.M. Higgins, British Association of Dermatologists' guidelines for the management of tinea capitis 2014
10. RxFiles Newsletter : Antifungal newsletter (April 2010) Canadian : Bugs and Drugs
11. Alok Kumar Sahoo et al, indian journal of dermatology 2016, Management of tinea corporis, tinea cruris, and tinea pedis: A comprehensive review
12. Craig G Burkhart et al. Tinea Versicolor Treatment & Management.medscape. updated Dec 2013
13. Clinical Practice Guidelines for the Management of Sporotrichosis: 2007 Update by the Infectious Diseases Society of America
14. Centers for Disease Control and Prevention (CDC) 2010

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


15. IDSA Guidelines for Intravascular Catheter-Related Infection • CID 2009:49
16. ESPID Reports and Review : The Pediatric Infectious Disease Journal 2014
17. Rook Textbook Dermatology 4th edition (www.dermnetnz.org)

## SURGICAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **A. GENERAL SURGERY** | | | |
| **Acute Pancreatitis** | | | |
| **Mild to moderate** | No antibiotics | | Antibiotics should be given for extra-pancreatic infections, such as cholangitis, catheter-acquired infections, bacteremia, urinary tract infections and pneumonia. |
| **Severe**<br>Antibiotics are mainly indicated for infected pancreatic necrosis.<br><br>Possible causative organisms:<br>Enterobacterales<br>Enterococci<br>*Staphylococcus aureus*<br>*Streptococcus*<br>*Staphylococcus epidermidis*<br>Anaerobes<br>*Candida* sp. (rarely) | *Piperacillin/tazobactam 4.5g IV q6-8h | Cefoperazone 1-2g IV q12h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Modify antibiotics once culture and sensitivity are available.<br><br>Reserve carbapenem for infections caused by resistant pathogens.<br><br>*Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **Diverticulitis**<br>Antibiotics considered for patients with the following:<br>Fever, elevated WBC, patients who have failed to respond to conservative management | | | |
| Diverticulitis | Amoxicillin/clavulanate 625mg PO q8h for 5 days | **Non-severe penicillin allergy:**<br>Cefuroxime 1.5g IV q8h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| (Not undergoing a source control procedure) | **OR**<br>Ampicillin/sulbactam 3g IV q6h | **PLUS**<br>Metronidazole 500mg IV q8h | |
| Diverticulitis<br>(Severe infection/life threatening infection) | *Piperacillin/tazobactam 4.5g IV q6-8h for 7 days | **Severe penicillin allergy:**<br>Ciprofloxacin 400mg IV q12h<br>**PLUS**<br>Metronidazole 500mg IV q8h | *Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **Breast abscess/Mastitis**<br><br>Common organism:<br>*Staphylococcus aureus* | Cloxacillin 1-2g IV q6h<br>**OR**<br>Cefazolin 1-2g IV q8h | Amoxicillin/clavulanate 625mg PO q8h<br>**OR**<br>Ampicillin/sulbactam 750mg PO q12h<br><br>**Penicillin allergy:**<br>Clindamycin 600mg IV/PO q8h | Drainage may be required for abscess.<br><br>For lactating mastitis:<br>Consider sending breast milk for C&S if not responding after 48 hours of initial antibiotic therapy or recurring mastitis.<br><br>Duration: 10 to 14 days but shorter courses (5 to 7 days) can be used if the response to therapy is rapid and complete. |
| **Hernia repair with mesh** | Refer to Chemoprophylaxis-Surgical | | |
| **Appendicitis**<br><br>Common organisms:<br>Enterobacterales<br>Enterococci<br>Bacteroides | Cefuroxime 1.5g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Ampicillin/sulbactam 1.5g IV q6-8h<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV q8h | Acute appendicitis without evidence of perforation, abscess, or local peritonitis; treatment should be discontinued within 24 hours.<br><br>For patients with various forms of appendicitis not undergoing a source |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | control procedure, change to early oral therapy.<br><br>Duration: 4-7 days |
| **Perforated Appendix/Appendicular Mass** | Cefuroxime 1.5g IV q8h<br>**OR**<br>Cefoperazone 1-2g IV q12h<br><br>**PLUS**<br>Metronidazole 500mg IV q8h | Ampicillin/sulbactam 1.5-3g IV q6-8h<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV q8h | Duration: 4-7 days |
| **Perforated Viscus Peritonitis** | Cefuroxime 1.5g IV q8h<br>**OR**<br>Cefoperazone 1-2g IV q12h<br><br>**PLUS**<br>Metronidazole 500mg IV q8h | Ampicillin/sulbactam 1.5-3g IV q6-8h<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV q8h | Duration: 4-7 days |
| **Abdominal trauma**<br>**Stab wound**<br>**Suspected bowel or solid organ injury**<br><br>Common organisms:<br>Gram-negative enteric aerobes and anaerobes | Amoxicillin/clavulanate 1.2g IV q8h | Cefuroxime 1.5g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Duration: 4-7 days (if adequate source control, no delay in surgical intervention and patient has rapid recovery)<br><br>*Piperacillin/tazobactam: if given as q8h, to be given as extended infusion (over 3-4 hours). |
| | **Severe/Infected wound:**<br>Cefazolin 2g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**OR**<br>*Piperacillin/tazobactam 4.5g IV q6-8h | **Severe/Infected wound:**<br>Ciprofloxacin 400mg IV q12h<br>**PLUS**<br>Clindamycin 450-600mg IV q8h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Anal/Rectal abscess** | Amoxicillin/clavulanate 1.2g IV or 625mg PO q8h | | Drainage is required.<br><br>Duration: 4-7 days (if adequate source control, no delay in surgical intervention and patient has rapid clinical recovery)<br><br>Routine antibiotics are not recommended in otherwise healthy patients. |
| **Burn wound sepsis**<br><br>Likely organisms:<br>*Streptococcus pyogenes*<br>*Staphylococcus aureus*<br>*Enterobacter* spp.<br>*Staphylococcus epidimidis*<br>*Enterococcus faecalis*<br>*Pseudomonas aeruginosa* | *Piperacillin/tazobactam 4.5g IV q6-8h | Cefepime 1-2g IV q8h | *S. aureus* tends to remain localised to burn wounds, if toxic, consider toxic shock syndrome.<br><br>*Candida* sp. colonise seldom invades.<br><br>Once C&S results are available, antibiotic therapy should be adjusted accordingly.<br><br>*Piperacillin/tazobactam: if given as q8h, to be given as extended infusion (over 3-4 hours). |
| **VASCULAR** | | | |
| **Mycotic aneurysm**<br>(Initial Treatment)<br>Vascular prosthesis infection<br><br>Common organisms: | Ceftriaxone 2g IV q24h<br><br>***Step down therapy:**<br><br>Ciprofloxacin 250mg PO q12h | *Piperacillin/tazobactam 4.5g IV q6-8h | Duration: At least six weeks (IV then oral based on clinical response and cultures) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| *Streptococcus pneumoniae*<br>*Staphylococcus aureus* (30%)<br>*Salmonella* sp. (50%) | **OR**<br>Amoxicillin/clavulanate 625mg PO q8h | | *Piperacillin/tazobactam: if given as q8h, to be given as extended infusion (over 3-4 hours).<br><br>Consider adding Vancomycin if suspecting MRSA/CoNS or vascular prosthesis infection<br><br>*CRP monitoring upon follow-up |
| **Ischaemic limb ulcers with infection** | Ampicillin/sulbactam 1.5-3g IV q6-8h for 7 days (to continue until C&S available) | Amoxicillin/clavulanate 1.2g IV q8h for 7 days (to continue until C&S available) | Duration depends on the extent of the infection (longer if bone is involved) |
| **BITES (penetrating injuries)** | | | |
| **Animal bite**<br><br>Common organisms:<br>*Staphylococcus aureus*<br>*Streptococcus*<br>Gram-negative Bacilli<br>Anaerobes<br>*Pasturella* (50% dog bites and 75% cat bites)<br>*Eikenella corrodens*<br>*Pseudomonas* sp. | Amoxicillin/clavulanate 625mg PO q8h | Doxycycline 100mg PO q12h<br>**PLUS**<br>Clindamycin 300mg PO q6h<br><br>**If severe/life threatening**:<br>Ampicillin/sulbactam 1.5-3g IV q6-8h<br>**OR**<br>Piperacillin/tazobactam 4.5g IV q8h | Prophylactic duration: 3-5 days<br>-Associated crush injury<br>-In the hands or proximity to a joint<br>-Associated edema<br>If wound is infected: 10 days or longer is recommended<br><br>*Piperacillin/tazobactam: if given as q8h, to be given as extended infusion (over 3-4 hours). |
| | **If severe/life threatening**:<br>Ampicillin/sulbactam 1.5-3g IV q6-8h | **If severe/life threatening**:<br>*Piperacillin/tazobactam 4.5g IV q6-8h | |
| **Human bite**<br><br>Common organisms:<br>*Staphylococcus aureus* | Amoxicillin/clavulanate 625mg PO q8h | **Penicillin Allergy:**<br>Clindamycin 300mg PO q6h<br>**PLUS**<br>Ciprofloxacin 500-750mg PO q12h | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Anaerobes<br>*Eikenella corrodens*<br>*Streptococcus* (esp *viridans*) | | **OR**<br>Trimethoprim/sulfamethoxazole 160/800mg PO q12h | |


**References:**

1. Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surgical Infections. 2017;8(1).
2. Bradley E. A Clinically Based Classification System for Acute Pancreatitis. Summary of the International Symposium on Acute Pancreatitis, Atlanta, Ga, September 11 Through 13, 1992. Arch Surg. 1993;128(5):586-90.
3. Neil Stollman WS, Ikuo Hirano et al. American Gastroenterological Association Institute Guideline on the Management of Acute Diverticulitis. Gastroenterology. 2015;149(7):1944–194.
4. Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis--2012: revision of the Atlanta classification and definitions by international consensus. Gut. 2013;62(1):102-11.
5. Perez A WE, Brooks DC, et al. Is severity of necrotizing pancreatitis increased in extended necrosis and infected necrosis? Pancreas. 2002;25(3):229-33.
6. Australian Clinical Practice Guidelines. Therapeutic guidelines antibiotic version 15. Australian Governement, National Health and Medical Research Council 2014.
7. Joseph A, Weston V, Catt L. Antimicrobial Prescribing Guidelines for Primary Care 2017. National Health Services (NHS) Nottinghamshire Area Prescribing Committee. 2017.
8. Dennis L. Stevens, Alan L. Bisno, Henry F. Chambers, E. Patchen Dellinger, Ellie J. C. Goldstein, Gorbach SL, et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. Clinical Infectious Diseases 2014;59(2):e10–52. 2014;59(2):e10-52.
9. University Malaya Medical Centre Antibiotic Guidelines Edition 2017. 2017.
10. Wilson B. Necrotizing fasciitis. Am Surg. 1952;18(4):416-31.
11. Burpee JF EP. Fournier's gangrene. J Urol. 1972;107(5):812-4.
12. Currie B. Melioidosis: The 2014 Revised RDH Guideline. The Northern Territory Disease Control Bulletin 2014;21(2)
13. IDSA Practice Guidelines, April 2014.


**B. BONE AND JOINT INFECTIONS**

**OSTEOMYELITIS**

| | | | |
|---|---|---|---|
| **Acute Osteomyelitis** | **Empirical coverage:** | **Penicillin allergy:**<br>Cefazolin 2g IV q6-8h | Duration: Initial IV therapy for 2-4 weeks followed by oral therapy. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Common organisms:<br>*Staphylococcus aureus* (80%)<br>Group *A Streptococcus pyogenes*<br>Rarely Gram-negative bacilli | Cloxacillin 2g IV q6h<br><br>To tailor antibiotics according to definitive cultures | | Minimum 6 weeks. Modify according to clinical response.<br><br>A shorter duration of antibiotic can be considered if the osteomyelitis is fully resected (e.g. amputation with a clear margin):<br>- No surrounding soft tissue infection: 5 days.<br>- Evidence of soft tissue infection: 10-14 days. |
| **Chronic Osteomyelitis**<br><br>Definition:<br>- Relapsing infection despite adequate duration of appropriate antibiotic<br>- Chronic pain/swelling/bone tenderness associated with tissue necrosis, increased drainage or persistent sinus tracts.<br>- Presence of bone destruction and presence of sequestra on imaging<br><br>Common organism:<br>*Staphylococcus aureus* | Empirical treatment before taking adequate cultures is not recommended<br><br>Choice of antibiotic depends on C&S result from tissue/bone as swab culture NOT reliable.<br><br>Thorough surgical debridement required (Removal of deadbone/orthopaedic hardware) | | Duration: 6 weeks but usually > 3 months<br><br>Treat until inflammatory parameters are normal |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Vertebral Osteomyelitis**<br>**Epidural Abscess**<br><br>Common organisms:<br>*Staphylococcus aureus* (main)<br>*Brucella*<br>*Salmonella*<br>Gram-negative Bacilli | Empirical therapy should be withheld unless the patient is septic or in patients with neurologic compromise.<br><br>Cloxacillin 2g IV q4h<br><br>To tailor antibiotics according to definitive cultures. | Cefazolin 2g IV q6-8h | Empiric Gram-negative should be covered if patient had:<br>-Recent spinal hardware inserted or surgery<br>-Intra-abdominal infections<br>-Coexisting or synchronous genitourinary infection<br>-HIV infection<br><br>Surgical therapy is necessary in:<br>-Spinal cord compression/instability<br>-Persistence of epidural abscess despite adequate antibiotic<br>-Considering TB spine/MDR organisms |
| | Duration:<br>Minimum 6 weeks.<br>Minimum 8 weeks if undrained paravertebral abscess(es) and/or infection due to drug-resistant organisms<br>Up to 12 weeks if extensive bone destruction. | | |
| **SEPTIC ARTHRITIS** | | | |
| **Acute monoarticular**<br>In person who do not have any risk factors for STD (*Staphylococcus*/ *Streptococcus*) | Cloxacillin 2g IV q4-6h<br><br>Duration:<br>IV therapy 2-4 weeks<br>Oral therapy to complete total 4-6 weeks | **Penicillin allergy:**<br>Cefazolin 2g IV q6-8h<br>**OR**<br>Clindamycin 600mg IV q6h,<br>followed by oral therapy (same dose)<br>**OR**<br>*Vancomycin 15-20mg/kg (actual body weight) IV q8-12h; not to exceed 2g/dose<br><br>Duration:<br>IV therapy 2-4 weeks<br>Oral therapy to complete total 4-6 weeks | Drainage, debridement and washout the infected joint is important to limit further damage.<br><br>A shorter duration of therapy is possible in immunocompromised patients who have had adequate surgical drainage.<br><br>*Vancomycin:<br>If suspected/confirmed MRSA, consider loading dose 25-30mg/kg for critically ill/ septic patients to achieve faster steady state. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Empirical therapy wherever possible should be directed by the result of Gram stain of the joint aspirate. |
| **Acute monoarticular**<br>In person who have risk factors for STD (Gonorrhea/*Streptococcus*/ *Staphylococcus*/ Gram-negative Bacilli) | Ceftriaxone 2g IV q24h for 1-2 weeks<br><br>**PLUS**<br>Azithromycin 1g PO stat<br>**OR**<br>Doxycycline 100mg PO q12h for 7 days | Cefotaxime 2g IV q8h for 1-2 weeks<br><br>**PLUS**<br>Azithromycin 1g PO stat<br>**OR**<br>Doxycycline 100mg PO q12h for 7 days | |
| **Polyarticular**<br>Gonorrhoea | Ceftriaxone 2g IV q24h for 7 days | | |


**References:**
1. Katie A. et.al. Curr Rheumatol Rep (2013) 15:332.
2. Mathews CJ et al Lancet 2010 375(9717): 846.
3. Barberi et al . CID2015.
4. George Varghese et al. BMJ 2010;341:c5470.
5. Michales pentali. EFORT Open Rev 2016.


**PROSTHETIC JOINT INFECTION**

| | | | |
|---|---|---|---|
| **Prosthetic Joint Infections (Empirical)**<br>Early: < 3 months after surgery<br>*Staphylococcus aureus*<br>Gram-negative Bacilli<br><br>Delayed onset: from 3 to 12 months after surgery | | | **Treatment concepts:**<br>1. Empirical therapy is not recommended<br>2. Treatment is based on C&S<br>3. Rifampicin should never be used alone and should be started only after the clearance of bacteremia. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Less purulent organisms:<br>CoNS/*Enterococcus*/ anaerobes<br><br>Late onset: >12 months after surgery<br>*Staphylococcus aureus*<br>Enterobacterales<br>Beta-hemolytic *Streptococcus*<br>Anaerobes | | | 4. Treatment strategy and duration of treatment depends on surgical strategy. |
| **Definitive Prosthetic Joint infection treatment**<br>Methicillin-sensitive *Staphylococcus aureus* (MSSA) | Initial Treatment:<br>Cloxacillin 2g IV q4-6h<br>**OR**<br>Cefazolin 2g IV q6-8h<br><br>**PLUS**<br>Rifampicin 600mg PO q24h or 450mg PO q12h | | Duration: 2-6 weeks (according to treatment strategy)<br><br>Followed by an oral combination therapy according to susceptibility. Rifampicin should be included if the implant is *in situ*. |
| **Definitive Prosthetic Joint Infection treatment**<br>Methicillin-resistant *Staphylococcus aureus* (MRSA) | Initial treatment:<br>Vancomycin 15-20mg/kg (actual body weight) IV q8-12h; not to exceed 2g/dose<br>**PLUS**<br>Rifampicin 300-450mg PO q12h | | Duration: 2-6 weeks (according to treatment strategy)<br><br>Followed by an oral combination therapy according to susceptibility. Rifampicin should be included if the implant is *in situ*. |
| **DIABETIC FOOT INFECTIONS** | | | |
| Antibiotics should not be used unless there are local or systemic symptoms of infection. Local treatment including surgical debridement is important. Antibiotic selection should be based on the most recent culture and sensitivity report. | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Mild Infections:**<br>a. Local infection involving skin & subcutaneous tissues<br>b. Erythema, less than 2 cm around the ulcer<br>c. No systemic signs of infection | Amoxicillin/clavulanate 625mg PO q8h<br>**OR**<br>Ampicillin/sulbactam 375-750mg PO q12h | Cephalexin 500mg PO q6h<br>**PLUS**<br>Metronidazole 400mg PO q8h | Duration: 5-7 days |
| **Moderate Infection:**<br>a. Deep tissue infection<br>b. Erythema more than 2 cm around ulcer<br>c. No SIRS | Ampicillin/sulbactam 3g IV q6-8h<br><br>**If *Pseudomonas* is suspected:**<br>*Piperacillin/tazobactam 4.5g IV q6-8h | Cefazolin 2g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**Penicillin allergy:**<br>Ciprofloxacin 400mg IV q8-12h<br>**PLUS**<br>Clindamycin 600mg IV q8h | Duration: 7-14 days<br>Modify according to clinical response.<br><br>If proven osteomyelitis or margin of resection is inadequate: at least 4-6 weeks. However, a shorter duration (1-2 weeks) is sufficient if the margin of surgical resection is adequate.<br><br>*Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours). |
| **Severe Infections:**<br>All of the above<br>2 or more SIRS<br>-History of previous antibiotic exposure<br>- Recurrent admission<br>-Risk of pseudomonas infection | *Piperacillin/tazobactam 4.5g IV q6-8h<br>If given as q8h, to be given as extended infusion (over 3-4 hours) | Cefepime 2g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Surgical debridement is URGENT.<br><br>Based on intraoperative C&S, antibiotics should be streamlined.<br><br>Duration: 7-14 days (subject to clinical improvement) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| -Immunocompromised | | | If proven osteomyelitis or margin of resection is inadequate: at least 4-6 weeks<br><br>A shorter duration of antibiotics can be considered if the osteomyelitis is fully resected (i.e. amputation with a clear margin):<br>-No surrounding soft tissue infection: 5 days<br>-Evidence of soft tissue infection: 10-14 days |
| **NECROTIZING FASCIITIS** | | | |
| **Type 1**<br>**Polymicrobial infection**<br><br>Primarily occurs in patients who are immunocompromised or have certain chronic diseases such as diabetes | *Piperacillin/tazobactam 4.5g IV q6-8h<br>**PLUS/MINUS**<br>**Clindamycin 600-900mg IV q8h | Cefotaxime 2g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h<br><br>**OR**<br>**Clindamycin 600-900mg IV q8h<br><br>**OR**<br>Ampicillin/sulbactam 3g IV 6-8h<br>**PLUS/MINUS**<br>**Clindamycin 600-900mg IV q8h | *Piperacillin/tazobactam: If given as q8h, to be given as extended infusion (over 3-4 hours).<br><br>**Clindamycin:<br>Only necessary if risk of Group A *Streptococcus*/presence of gas crepitus or suspected toxic shock syndrome.<br><br>Immediate aggressive surgical debridement is the primary treatment modality<br><br>Repeated surgical debridement for source control is normally necessary. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Urgent Gram stain<br><br>Based on intraoperative culture & sensitivity, antibiotics should be streamlined. |
| **Type 2**<br>**Monomicrobial infection**<br>Group A *streptococcus* (most common) | Benzylpenicillin 2-4MU IV q4h<br>**PLUS**<br>*Clindamycin 600-900mg IV q8h | | *Clindamycin:<br>Only necessary if risk of Group A *Streptococcus*/presence of gas crepitus or suspected toxic shock syndrome.<br><br>Duration: 7-14 days (subject to clinical assessment) |
| *Vibrio vulnificus*<br>*Aeromonas hydrophila*<br>Consider in water related injuries and patients with liver cirrhosis and ingestion of raw oysters | Ceftriaxone 1g IV q12h<br>**PLUS**<br>Doxycycline 100mg PO q12h | Ciprofloxacin 400mg IV q8h | |
| **Fournier's Gangrene**<br><br>Common organisms:<br>*Eschericia coli*<br>*Klebsiella*<br>*Proteus*<br>*Enterococcus*<br>*Pseudomonas*<br>Anaerobes | Ampicillin/sulbactam 3g IV q6-8h | *Piperacillin/tazobactam 4.5g IV q6-8h<br><br>**OR**<br><br>Ceftriaxone 2g IV q24h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Aggressive surgical debridement is necessary to remove all necrotic tissues.<br><br>*Piperacillin/tazobactam: if given as q8h, to be given as extended infusion (over 3-4 hours) |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **SOFT TISSUE INFECTION SECONDARY TO GAS PRODUCING ORGANISM** | | | |
| Common organisms:<br>*Clostridium* sp<br>Gram-negative organisms | Benzylpenicillin 4MU IV q4h<br>**PLUS**<br>Clindamycin 600-900mg IV q6h<br>**PLUS/ MINUS**<br>*Gentamicin 5mg/kg IV q24h | Cefotaxime 2g IV q8h<br>**PLUS**<br>Clindamycin 600-900mg IV q6h | Duration: 10-28 days<br><br>*Gentamicin: if suspected Gram-negative infection. early aggressive surgical debridement is essential. |
| **SUPPURATIVE WOUND INFECTIONS, SURGICAL OR TRAUMATIC** | | | |
| Suppurative wound infections, surgical or traumatic | If there is surrounding cellulitis and/or systemic symptoms are present:<br>Cloxacillin 500mg PO/IV q6h<br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h (if gram negative organisms suspected or known to be involved)<br><br>**OR**<br>As a monotherapy:<br>Cefuroxime 1.5g IV q8h | | Change antibiotics accordingly after C&S results are available.<br><br>Topical antibiotics are not recommended for treatment of wound infections as it may result in the emergence of resistant organisms.<br><br>Patient tetanus immunisation status 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 2g IV q6h<br>**PLUS/MINUS**<br>*Metronidazole 500mg IV q6h<br>**PLUS/MINUS**<br>**Gentamicin 5mg/kg IV q24h | Cefazolin 2g IV q6-8h<br><br>**OR**<br><br>Cefuroxime 1.5g IV as a loading dose, followed by 750mg IV q8h<br>**PLUS** | *Metronidazole: in soil/rust contamination or heavy machinery.<br><br>**Gentamicin: if there is extensive skin and soft tissue involvement |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | *Metronidazole 500mg IV q8h | Thorough surgical debridement, soft tissue and fracture stabilization.<br><br>For severe penetrating injuries, especially those involving joints and/ or tendons, antibiotics must be given for at least 5 days**.** |
| **COMPOUND FRACTURES/OPEN FRACTURES** | | | |
| Compound fractures: Antibiotics are administered as prophylaxis within 3 hours of injury. | | | |
| **Gustilo I & II fractures** | Cefazolin 1-2g IV q8h<br>**OR**<br>Cefuroxime 1.5g IV q8h | Amoxicillin/clavulanate 1.2g IV q8h | Pre-debridement and post-debridement cultures are not representative of actual infection. |
| **Gustilo III fractures**<br>Mostly nosocomial and Gram-positive | As per Gustilo 1 & 2 fractures<br>**PLUS**<br>*Gentamicin 3-5mg/kg IV stat dose<br>**PLUS/MINUS**<br>**Metronidazole 500mg IV q8h | | Duration of antibiotic for open fractures classification:<br>- Gustillo type 1: stop after 24 hrs<br>- Gustilo type II: stop after 24 hrs to 48 hrs<br>- Gustilo type III: 24 hrs after wound closure or up to a maximum of 72 hrs (whichever is earlier)<br><br>*Gentamicin: if initial debridement is expected to last more than 2 hours, a higher dose of gentamicin 5mg/kg IV stat is needed.<br><br>**Metronidazole: in soil/rust contamination or heavy machinery. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | If soft tissue injury is of concern, to follow antibiotic guidelines for soft tissue injury. |


**References:**
1. Zimmerli et al. NEJM 2004; 14;351;1645.
2. Del Pozo JL. NEJM.2009 361(8): 787
3. IDSA guidelines, Clinical Infectious Diseases ; 2012 ; 54 : 132-173 2012
4. Luca L.et al.International Journal of Infectious Diseases (2005) 9, 127
5. Michealis et al.. EFORT Open Rev 2016;1:128
6. Dennis L et al. N Engl J Med 377;23
7. Nayagam S. et al. British Orthopaedic Association Standards for Trauma. 2009


## C. NEUROSURGERY

Antibiotic usage is not recommended for:
- Traumatic CSF fistula
- Post-surgical CSF leak
- Basal skull fractures

However, it should be highlighted that these groups of patients have increased risks of meningitis due to increased possibility of bacteria from the paranasal sinuses, nasopharynx and the ear canal making direct contact with the CNS as well as cerebrospinal fluid (CSF) leak, rendering antibiotic use needed in some situations.
CSF leak would resolve spontaneously on day 5-7, or with the help of external lumbar drain. Patients with persistent CSF leak should have CSF cultures to guide antibiotic therapy. Patients with clinical presentation consistent with meningitis such as fever/altered consciousness/photophobia/neck stiffness should be treated with empiric antibiotics until culture results are available.

| | | | |
|---|---|---|---|
| **Compound depressed skull fractures/Open skull fracture** | Cefuroxime 1.5g IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h | | Duration: 5-7 days<br><br>Review tetanus status of patients and consider vaccination. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Surgical debridement within 12-24 hours is important to remove the source of infection. |
| **Penetrating craniocerebral injuries** | Ceftriaxone 2g IV q12h<br>**PLUS**<br>Metronidazole 400mg PO q8h | | Duration: 2 weeks initially and then review with microbiology |

**References:**

1. Salford Royal, NHS. Antibiotic Prophylaxis in Cranial Neurosurgery Antibiotic Guidelines, Unique ID: 144TD(C)25(F4) Issue number: 6, 2018.

## TROPICAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **1. Typhoid Fever** (*Salmonella enterica* serovar Typhi and Paratyphi) | | | |
| **Uncomplicated** | Ceftriaxone 50-75mg/kg/24h (2-4 g/day) IV q12-24h for 5-7 days | Ciprofloxacin 500mg PO q12h for 5-7 days<br>**OR**<br>Azithromycin 1g PO stat, then 500mg PO q24h for 5-7 days | Ceftriaxone is recommended for quinolone resistance.<br><br>Recommend for early IV to oral switch once symptoms improved or stabilised. |
| **Complicated/Severe**<br>(patients with systemic toxicity, depressed consciousness, prolonged fever, organ system dysfunction or other features that prompt hospitalization) | Ceftriaxone 50-75mg/kg/24h (2-4 g/day) IV q12-24h for 10-14 days<br>**OR**<br>Cefotaxime 40-80mg/kg/24h (2-6 g/day) IV q8-12h for 10-14 days<br><br>**PLUS/MINUS**<br>*Dexamethasone 3mg/kg IV followed by 1mg/kg IV q6h for 2 days | Ciprofloxacin 400mg IV q12h for 10-14 days<br>**OR**<br>**Meropenem 1-2g IV q8h for 10-14 days<br><br>**PLUS/MINUS**<br>*Dexamethasone 3mg/kg IV followed by 1mg/kg IV q6h for 2 days | *Indication of dexamethasone (adjunctive):<br>I. Typhoid psychosis<br>Ii. Septic shock and other indications (discuss with ID physician)<br><br>**Carbapenems should be reserved for patients who have severe or complicated infection with a suspected extensively drug-resistant strain.<br><br>Recommend for early IV to oral switch once symptoms improved or stabilised |
| **2. Cholera** (*Vibrio cholerae*) | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Non-Tetracycline resistance** | Doxycycline 300mg PO stat | Ciprofloxacin 1g PO stat | Rehydration is the mainstay of cholera treatment.<br><br>Avoid antidiarrheal agents e.g. Diphenoxylate/atropine (Lomotil®) or Loperamide<br><br>**Indication for antibiotics:**<br>i) Severely ill patients especially who are severely or moderately dehydrated and continue to pass a large volume of stool during rehydration treatment.<br>ii) All patients who are hospitalised and moderate to severe cases.<br><br>*Azithromycin/Erythromycin: Recommended alternatives for pregnant women |
| **Tetracycline resistance** | Ciprofloxacin 1g PO stat<br>**OR**<br>*Azithromycin 1g PO stat | *Erythromycin ethylsuccinate 800mg PO q12h for 3 days | |
| **3. Scrub Typhus** *(Orientia tsutsugamushi (Rickettsia tsutsugamushi))* | | | |
| **Uncomplicated** | Doxycycline 100mg PO q12h for 7 days | *Azithromycin 500mg PO stat | *Azithromycin: Recommended for pregnant women |
| **Complicated**<br>(ARDS, septic shock, myocarditis, meningoencephalitis, hepatitis, renal failure) | *Azithromycin 500mg IV q24h for 5 days | Rifampicin 600mg PO q24h for 5 days (if not responding to azithromycin) | *Recommend for early IV to oral switch once symptoms improve or stable |
| **4. Brucellosis** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| *Brucella melitensis, Brucella abortus, Brucella suis and Brucella canis* | Doxycycline 100mg PO q12h for 6 weeks<br>**PLUS**<br>Streptomycin 1g (15mg/kg) IM q24h for 2 - 3 weeks | Doxycycline 100mg PO q12h for 6 weeks<br>**PLUS**<br>Gentamicin 5mg/kg/24h IV for 7 days<br><br>**OR**<br><br>Doxycycline 100mg PO q12h for 6 weeks<br>**PLUS**<br>Rifampicin 600-900mg (15mg/kg) PO q24h for 6 weeks<br><br>**OR**<br><br>*Rifampicin 600-900mg (15mg/kg) PO q24h for 6 weeks<br>**PLUS**<br>*Trimethoprim/sulfamethoxazole 160/800mg PO q12h for 6 weeks | Longer duration (up to 12 weeks) may be required in complicated cases e.g. spondylitis, neurobrucellosis, infective endocarditis, localised suppurative lesions<br><br>*Recommended alternative for pregnant women. Optimal therapy for pregnant women has not been determined. Trimethoprim/sulfamethoxazole has been used with success. Another alternative is rifampicin monotherapy for at least 45 days. |
| **5. Leptospirosis** (*Leptospira* sp.) | | | |
| **Mild to Moderate disease** | Doxycycline 100mg PO q12h for 5-7 days | *Azithromycin 500mg PO q24h for 3 days | *Recommended alternative for pregnant women |
| **Severe disease**<br>(Leptospiral pulmonary syndrome, multiorgan involvement, sepsis) | Benzylpenicillin 1.5MU IV q6h<br>**OR**<br>Ceftriaxone 1-2g IV q24h for 7 days | | May consider Methylprednisolone 500-1000 mg IV for 3 days if pulmonary haemorrhage is present. However, there is insufficient evidence to support the routine use of corticosteroid. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **6. Tetanus** | | | |
| *Clostridium tetani* | Metronidazole 500mg IV q6h-q8h for 7-10 days<br>**PLUS**<br>Human Tetanus Immunoglobulin 3000- 6000IU IM stat<br>**PLUS**<br>Anti-tetanus toxoid vaccine IM (initiate age appropriate active immunization at a different site) | Benzylpenicillin 100,000-200,000 unit/kg/24h IV q6h for 7-10 days<br>**PLUS**<br>Human Tetanus Immunoglobulin 3000- 6000IU IM stat<br>**PLUS**<br>Anti-tetanus toxoid vaccine IM (initiate age appropriate active immunization at a different site) | Human Tetanus Immunoglobulin 500IU might be as effective as higher doses of 3,000 to 6,000IU and causes less discomfort.<br><br>All patients with tetanus should undergo wound debridement to eradicate spores and necrotic tissues. |
| **7. Melioidosis** (*Burkholderia pseudomallei)* | | | |
| **Intensive Therapy (uncomplicated)** | Ceftazidime 100-120mg/kg/24h IV q6h-q8h (usual dose: 2g IV q6h)<br>**PLUS/MINUS**<br>*Trimethoprim/sulfamethoxazole<br>● < 40kg: 160/800mg IV/PO q12h<br>● 40-60kg: 240/1200mg IV/PO q12h<br>● >60kg: 320/1600mg IV/PO q12h | | *Add on trimethoprim/sulfamethoxazole in eye, neurologic, testicular, prostatic, pericardium, bone and joint melioidosis.<br><br>Drainage of abscesses should be attempted where ever appropriate such as prostatic, empyema and pericardium.<br><br>Duration of intensive therapy:<br>● Skin, bacteraemia with no foci, mild pneumonia: 2 weeks<br>● Complicated pneumonia, prostatic, deep-seated foci, septic arthritis: 4 weeks<br>● Osteomyelitis: 6 weeks |
| **Intensive Therapy (complicated)** | Meropenem 75mg/kg/24h IV q8h (with CNS involvement: 2g IV q8h; without CNS involvement: 1g IV q8h)<br>**OR**<br>Imipenem 50mg/kg/24h IV q6h (usual dose: 500-1000mg q6h)<br><br>**PLUS/MINUS**<br>*Trimethoprim/sulfamethoxazole<br>● < 40kg: 160/800mg IV/PO q12h | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | ● 40-60kg: 240/1200mg IV/PO q12h<br>● >60kg: 320/1600mg IV/PO q12h<br><br>(to deescalate to Ceftazidime once symptoms improve/stable) | | ● Neurologic/CNS: 8 weeks<br><br>Folic Acid 5mg PO q24h to be given for patients on trimethoprim/sulfamethoxazole. |
| **Eradication/Maintenance Therapy** | Trimethoprim/sulfamethoxazole<br>● < 40kg: 160/800mg PO q12h<br>● 40-60kg: 240/1200mg PO q12h<br>● >60kg: 320/1600mg PO q12h | Amoxicillin/clavulanate<br>● ≤ 60kg: 1250mg (2 tabs of 625mg) PO q8h<br>● > 60kg: 1875mg (3 tabs of 625mg) PO q8h | Duration of eradication therapy:<br>● Osteomyelitis, Neurologic/CNS: 24 weeks<br>● Others: minimum 12 weeks |

**8. Malaria**

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

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

**Clinical manifestation:**

Impaired consciousness or unrousable coma
Prostration (generalised 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
Clinical jaundice and evidence of other vital organ dysfunction
Haemoglobinuria
Abnormal spontaneous bleeding
Pulmonary oedema (radiological)

**Laboratory test:**

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Hypoglycaemia, metabolic acidosis, severe normocytic anaemia, haemoglobinuria, hyperparasitaemia (>20,000 parasites/microL for *P. knowlesi* or >100,000 parasites/microL for other *Plasmodium* species), hyperlactatemia or renal impairment. | | | |
| ***Plasmodium falciparum***<br>A. Non-complicated<br>i) New Infection | Riamet®<br>(1 tablet: Artemether/lumefantrine 20/120mg)<br><br>The patient should receive an initial dose, followed by a second dose 8 hours later, then 1 dose q12h for the following 2 days.<br><br><15kg: 1 tab per dose<br>15 - <25kg: 2 tab per dose<br>25 - <35kg: 3 tab per dose<br>≥35kg: 4 tab per dose<br><br>(Riamet should be taken with a fatty meal e.g milk to increase bioavailability) | | Primaquine 0.75mg/kg (max: 45mg) to be given on Day 1 as a single dose (gametocytocide) except in pregnant/lactating women. If G6PD status unknown before use, to use 0.25mg/kg.<br><br>Pregnancy:<br>-Pregnant women with uncomplicated *P. falciparum* malaria should be treated with artemether-lumefantrine during the first trimester.<br>-Exposure of Artemisinin derivatives during the second and third trimester has shown no adverse effects on the mother or fetus.<br><br>Lactating women: Do not use Primaquine and Tetracycline |
| ***Plasmodium falciparum***<br>B. Complicated/Severe | Artesunate 2.4mg/kg IV at 0 hour, 12 hour, 24 hour and q24h till day 7<br>**PLUS**<br>Doxycycline 100mg PO q12h for 7 days<br>(given together with IV Artesunate) | | Primaquine 0.75mg/kg (max 45mg) to be given on Day 1 of treatment (gametocytocide) in addition to Artemisinin regime and Quinine, except for pregnant women. If possible, check G6PD status before use. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Parenteral artesunate should be given for a minimum of 24 hours (3 doses) or until the patient can tolerate orally then it can be switched to a complete course of oral ACT regime. | | Pregnancy (all stage): Artesunate IV as for normal adults |
| ***Plasmodium vivax***<br>***Plasmodium ovale*** | Riamet®<br>(dosing as per *Plasmodium falciparum* treatment)<br>**PLUS**<br>*Primaquine 0.5mg/kg (max 30mg) PO q24h for 14 days | | *G6PD deficiency: Primaquine 0.75mg/kg PO once a week for 8 weeks. If significant haemolysis occurs, it should be stopped.<br><br>Pregnancy: Full course Riamet® to be given, followed by chloroquine 300mg PO once a week till delivery. Full course of primaquine only to be given post- delivery.<br><br>In severe *P. vivax* or *P. ovale* infections, the treatment is as severe as *P. falciparum.* |
| ***Plasmodium malariae***<br>***Plasmodium knowlesi*** | Riamet®<br>(dosing as per *Plasmodium falciparum* treatment) | | In severe *P. malariae* or *P. knowlesi* infections, the treatment is as severe as *P. falciparum.*<br><br>No radical cure with primaquine is required because no hypnozoites are formed in infection with these species. |
| **Mixed Infection** | Treat as *Plasmodium falciparum* | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Chemoprophylaxis** | Doxycycline 100mg PO q24h<br>Start: 1-2 days before departure<br>Stop: 4 weeks after travel<br>Maximum duration: 2 years<br>**OR**<br>*Atovaquone/proguanil (Malarone®) 100/250mg q24h<br>Start: 1-2 days before departure Stop: 7 days after travel | **Mefloquine 250mg PO once a week<br>Start: 2 weeks before departure<br>Stop: 4 weeks after travel<br>Maximum duration: 1 year | Pregnancy: Only Mefloquine can be used<br><br>Refer to the drug resistance pattern and recommended prophylaxis in the travelling destination (CDC website).<br><br>*Requires special medicine approval<br><br>**Not available in HRPB Formulary |

**References:**


1. CDC 2022. Recommendations for the Use of Antibiotics for the Treatment of Cholera. https://www.cdc.gov/cholera/treatment/antibiotic-treatment.html
2. WHO Global Task Force on Cholera Control 2020. https://choleraoutbreak.org/book-page/section-7-case-management-treatment-facilities
3. Rahi M, etal.DHR-ICMR Guidelines for Diagnosis & Management of Rickettsial Diseases in India. Indian J Med Res. 2015;141(4):417-22.
4. Kim YS et al. A comparative trial of single dose azithromycin vs doxycycline for treatment of old mild scrub typhus. CID. 2004; 39(9):1329-35
5. WHO. Brucellosis in humans and animals. 2006
6. MOH Malaysia. CPG Brucellosis. 2012
7. CDC Yellow Book 2019: Brucellosis. https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/brucellosis
8. WHO. Leptospirosis. 2013.
9. CDC Yellow Book 2019: Leptospirosis. https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/leptospirosis
10. Phimda K, et al. Doxycycline vs azithromycin for treatment of leptospirosis and scrub typhus. Antimicrob Agents Chemother. 2007;51(9):3259-63
11. Panaphut, T et al. Ceftriaxone compared with s.penicillin G for treatment of severe leptospirosis. CID. 2003;36(12), 1507-1
12. Suputtamongkol Y, et al. An open RCT comparing penicillin, doxycycline and cefotaxime for patients with severe leptospirosis. CID 2004:39(10):1417-24
13. Shenoy VV et al. Pulmonary leptospirosis: an excellent response to bolus methylprednisolone. Postgrad Med J. 2006; 82(971): 602–6
14. Rodrigo C et al. High dose corticosteroids in severe leptospirosis: a systematic review. Trans R Soc Trop Med Hyg. 2014;108(12):743-50
15. WHO. Current recommendations for treatment of tetanus. 2010.
16. CDC. Tetanus, Clinical information for clinicians. 2017

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


**17.** Currie B. Melioidosis: The 2014 Revised RDH Guideline. The Northern Territory Disease Control Bulletin. 2014;21(2): 4-8.
**18.** Dance D. Treatment and prophylaxis of melioidosis. Int J Antimicrob Agents 2014; 43: 310-8.
**19.** White NJ, et al. Halving of mortality of severe melioidosis by ceftazidime. Lancet. 1989;2: 697–701
**20.** Simpson AJ, et al. Comparison of imipenem and ceftazidime as therapy for severe melioidosis. CID. 1999;29:381–7
**21.** Management Guideline of Malaria in Malaysia 2013
**22.** WHO Guideline for Malaria 2023

## URINARY TRACT INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **1. CYSTITIS** | | | |
| **Uncomplicated Cystitis**<br><br>Common organisms:<br>*Escherichia coli*<br>Enterobacterales: *Klebsiella, Proteus*<br>*Staphylococcus saprophyticus*<br><br>In non-pregnant, pre-menopausal women with structurally and functionally normal urinary tract. | *Nitrofurantoin 50-100mg PO q6h (macrocrystals)<br>**OR**<br>Cephalexin 500mg PO q12h | Cefuroxime 250mg PO q12h<br>**OR**<br>Amoxicillin/clavulanate 625mg PO q8h<br>**OR**<br>Ampicillin/sulbactam 375-750mg PO q12h<br>**OR**<br>**Fosfomycin 3g PO x 1 dose | Urine culture is indicated only if symptoms are unresolved or recur.<br><br>*Nitrofurantoin should not be used if GFR < 30 mL/min.<br><br>**Consider Fosfomycin for patients suspected to have MDR Gram-negative infections.<br><br>Ciprofloxacin and other quinolones are not recommended as empirical treatment in UTIs due to selection of resistance, and potential serious adverse events.<br><br>Consider use of quinolones only in patients with history of anaphylactic reaction to beta-lactam antibiotics.<br><br>Duration of treatment: 5-7 days |
| **Cystitis in Pregnancy** | *Nitrofurantoin 50-100mg PO q6h (macrocrystals)<br>**OR**<br>Cephalexin 500mg PO q12h | Cefuroxime 250mg PO q12h<br>**OR**<br>**Amoxicillin/clavulanate 625mg PO q8h<br>**OR** | Obtain urine culture before starting treatment and repeat 1-2 weeks after completion of antibiotics to ensure eradication. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | Ampicillin/sulbactam 375-750mg PO q12h<br>**OR**<br>***Fosfomycin 3g PO x 1 dose | Duration of treatment: 5-7 days (treat for 7 days if recurrent)<br><br>*Avoid Nitrofurantoin at third trimester if other options are available due to small risk of haemolytic anaemia in newborn.<br><br>**Amoxicillin/clavulanate is generally safe in pregnancy (Category B), but there may be an increased risk of necrotizing enterocolitis associated with use in preterm, premature rupture of membranes.<br><br>Avoid fluoroquinolones in pregnancy.<br><br>***Consider Fosfomycin for patients suspected to have MDR Gram-negative infections. |
| **2. PYELONEPHRITIS** | | | |
| **Uncomplicated Pyelonephritis**<br><br>Common organisms:<br>Enterobacterales<br>Enterococci<br><br>In non-pregnant, pre-menopausal women | **<u>Outpatient treatment:</u>**<br>Amoxicillin/clavulanate 625mg PO q8h for 14 days<br>**OR**<br>Ampicillin/sulbactam 375-750mg PO q12h for 10-14 days | | Obtain culture before starting treatment.<br><br>Perform ultrasound of the upper urinary tract to exclude obstructive pyelonephritis. |
| | **<u>Inpatient treatment:</u>** | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| without urological abnormalities or comorbidities | Amoxicillin/clavulanate 1.2g IV q8h for 10-14 days<br>**OR**<br>Cefuroxime 750mg IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q8h | Ceftriaxone 1g IV q24h for 10 days | May step down to oral antibiotics guided by culture and sensitivity results once can tolerate orally and afebrile > 48 hours. |
| Pyelonephritis in other categories (e.g. pregnancy) | Treat as inpatient treatment for uncomplicated pyelonephritis | | |
| **3. OTHER URINARY TRACT INFECTIONS (UTIs)** | | | |
| **Complicated UTIs**<br><br>Common organisms:<br>Enterobacterales<br>Enterococci<br>*Pseudomonas* sp.<br><br>UTI symptoms in men OR presence of a structural or functional abnormality:<br>● Urinary tract obstruction<br>● Chronic kidney disease<br>● Poorly-controlled type 2 diabetes<br>● Immunosuppression<br>● Urinary catheter *in situ*<br>● Neurogenic bladder<br>● Post-menopausal women<br>● History of recurrent UTIs | **<u>Oral Therapy:</u>**<br>Amoxicillin/clavulanate 625mg PO q8h for 7 days<br>**OR**<br>Cephalexin 500mg PO q6h for 7 days | | Obtain urine culture before starting treatment.<br><br>Treat for 10-14 days in patients with upper tract symptoms, delayed response or sepsis.<br><br>May step down to oral antibiotics guided by culture and sensitivity results once can tolerate orally and afebrile > 48 hours. |
| | **<u>Parenteral Therapy:</u>**<br>Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q8h<br>**OR**<br>Cefuroxime 750mg IV q8h<br><br>**PLUS/MINUS**<br>Aminoglycoside | Ceftriaxone 1g IV q24h<br>**PLUS/MINUS**<br>Aminoglycoside | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| ● Nephrolithiasis | | | |
| **Asymptomatic Bacteriuria (ABU)**<br><br>Urine bacterial growth ≥ $10^5$cfu/mL in 2 serial samples in women or a single sample in men without UTI symptoms. | Screening and treatment is **ONLY recommended** in the following patients:<br>● pregnant women<br>**OR**<br>● patients undergoing invasive urological procedures i.e. prior to transurethral resection of prostate (TURP) or urological procedures breaching the mucosa (refer "surgical prophylaxis" for treatment)<br>Whenever indicated, treatment should be guided by urine culture and sensitivity results. | | Duration of treatment for pregnant women: 5-7 days<br><br>Antibiotics to consider in pregnant women include amoxicillin, nitrofurantoin and oral cephalosporin. |
| **Catheter-associated UTI (CA-UTI)**<br><br>Urine colony count ≥ $10^3$cfu/mL with at least one sign or symptom compatible with UTI, with no other identifiable source of infection. | Refer to "Complicated UTIs" | | Routine screening and treating asymptomatic catheterized patients are not recommended.<br><br>Pyuria alone in the absence of other symptoms is not diagnostic of CA-UTI.<br><br>Remove unnecessary catheters.<br><br>Whenever indicated, change the catheter prior to starting treatment.<br><br>Treat for 7 days for prompt resolution of symptoms or 10-14 days if delayed response or sepsis. |
| **Prophylaxis for Recurrent Urinary Tract Infections (rUTIs)** | Nitrofurantoin 50-100mg PO ON (macrocrystals)<br>**OR**<br>Cephalexin 250mg PO ON | | Antimicrobial prophylaxis is indicated if non-antimicrobial measures fail.<br><br>Post-coital prophylaxis may be appropriate for sexually-related rUTIs. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| 2 episodes/6 months OR > 3 episodes/year | | | When primary options fail, consider daily antibiotic prophylaxis guided by culture and sensitivity results.<br><br>Duration: 3-6 months |
| **4. UROLOGY** | | | |
| **Pyonephrosis/Perinephric Abscess/Renal Abscess**<br><br>Common organisms:<br>Enterobacterales<br>Enterococci<br>*Staphylococcus aureus*<br>*Pseudomonas* sp. | Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Cefuroxime 750mg IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q6-8h<br><br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | Ceftriaxone 2g IV q24h<br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | Obtain blood and urine cultures before starting treatment.<br><br>Send pus for culture and sensitivity.<br><br>Drainage the mainstay of treatment followed by definitive surgery if warranted.<br><br>Step down to oral antibiotics guided by culture and sensitivity results once can tolerate orally and afebrile > 48 hours following catheter removal.<br><br>Duration: 2-3 weeks (of both IV and oral)<br><br>Longer course of antibiotic if:<br>• Difficult to drain abscess<br>• Slow resolution on follow-up imaging. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Acute Prostatitis**<br><br>Common organisms:<br>Age < 35 years old<br>● *N. gonorrhea*<br>● *C. trachomatis*<br>Age ≥ 35 years old<br>● Enterobacterales<br>● Coliforms<br>● Enterococci<br><br>Fever, chills, malaise, myalgia, dysuria, irritative urinary symptoms (frequency, urgency, urge incontinence), pelvic or perineal pain, and cloudy urine. | **Outpatient treatment:**<br>Trimethoprim/sulfamethoxazole 160/800mg PO q12h<br>**OR**<br>Ciprofloxacin 500-750mg PO q12h | | Obtain urine cultures before starting treatment.<br><br>May step down to oral antibiotic once can tolerate orally and afebrile > 48 hours.<br><br>Duration: 2 weeks or up to 4 weeks in severe illness or concomitant bacteraemia. |
| | **Inpatient treatment:**<br>Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Ampicillin/sulbactam 3g IV q6- 8h<br>**OR**<br>Cefuroxime 750mg IV q8h<br><br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | Ceftriaxone 1-2g IV q24h<br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | |
| **Chronic Bacterial Prostatitis** (NIH Type II)<br><br>Chronic or recurrent urogenital symptoms that persist for at least 3 months.<br><br>Relapsing UTI with repeated isolation of the same organism from urine is the hallmark. | Ciprofloxacin 500mg PO q12h | Trimethoprim/sulfamethoxazole 160/800mg PO q12h | Reassess after 2 weeks of antimicrobial therapy.<br><br>Only continue antibiotics if pre-treatment cultures are positive and/or symptoms improve.<br><br>Duration: 4-6 weeks |
| **Epididymo-orchitis (non-STD related)** | Ciprofloxacin 500mg PO q12h for a minimum of 2 weeks | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Common organisms:<br>Enterobacterales<br>Enterococci<br>*Pseudomonas* sp.<br><br>Acute onset, usually unilateral scrotal pain swelling with or without fever, rigors, and lower urinary tract symptoms. | | | |
| **Epididymo-orchitis (STD related)** | Refer to Sexually Transmitted Infections Section | | |
| **Testicular Abscess**<br><br>Common organisms:<br>Enterobacterales<br>Enterococci<br>*Pseudomonas* sp. | Amoxicillin/clavulanate 1.2g IV q8h<br>**OR**<br>Ampicillin/Sulbactam 3g IV q6-8h<br>**OR**<br>Cefuroxime 750mg IV q8h<br><br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | Ceftriaxone 2g IV q24h<br>**PLUS/MINUS**<br>Gentamicin 5mg/kg IV q24h | Drainage is the mainstay of treatment.<br><br>Send pus for culture and sensitivity. |

**References:**


1. The Sanford Guide To Antimicrobial Therapy 2021. (Version 5.1.13) [Mobile app]
2. Guidelines on Urological Infections, European Association of Urology 2022, Available at: https://uroweb.org/guidelines/urological-infection (Accessed 10th June 2022)
3. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, Volume 68, Issue 10, 15 May 2019, Pages e83–e110, Available at: https://doi.org/10.1093/cid/ciy1121 (Accessed 10th June 2022)
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. Hooton TM. Urinary tract infections and asymptomatic bacteriuria in pregnancy. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA, Available at: https://www.uptodate.com/contents/urinary-tract-infections-and-asymptomatic-bacteriuria-in-pregnancy (Accessed 10th June 2022)

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


6. Abdelmoteleb, Haitham & Rashed, Fatima & Hawary, Amr. (2017). Management of prostate abscess in the absence of guidelines. International braz j urol : official journal of the Brazilian Society of Urology. 43. 10.1590/S1677-5538.IBJU.2016.0472.
7. Reddivari AKR, Mehta P. Prostatic Abscess. [Updated 2022 May 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available at: https://www.ncbi.nlm.nih.gov/books/NBK551663/ (Accessed 10th June 2022)
8. Ackerman A. L., Parameshwar P. S., Anger J. T. (2018). Diagnosis and treatment of patients with prostatic abscess in the post-antibiotic era. *Int. J. Urol.* 25, 103–110. Available at: https://onlinelibrary.wiley.com/doi/epdf/10.1111/iju.13451 (Accessed 10th June 2022)

## INFECTIONS IN PATIENTS ON LONG-TERM RENAL REPLACEMENT THERAPY

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **A. HAEMODIALYSIS-RELATED CATHETER-RELATED BLOODSTREAM INFECTION**<br>**(*Renal impairment adjusted doses are used in this section)*** | | | |
| **Empirical Therapy** | Ceftazidime 2g IV stat and 1g IV q24h<br>**PLUS**<br>Cefazolin 2g IV stat and 1g IV q24h | | Two sets of blood cultures should be obtained prior initiation of antibiotics.<br><br>Remove catheter (immediately) if:<br>- concurrent exit site infection (redness, pus)<br>- ill patients with septic shock<br><br>Linezolid IV is not an appropriate choice for empirical therapy |
| **Definitive Therapy** | | | |
| ***Staphylococcus aureus***<br><br>MSSA | Cefazolin 2g IV stat and 1g IV q24h | | Duration: 4 to 6 weeks. However, if the catheter is removed and bacteraemia resolved within 72h, a shorter duration of 2 weeks may be appropriate.<br><br>Transthoracic ECHO (TTE) should be pursued in the setting of *S. aureus* bacteraemia to rule out infective endocarditis. |
| MRSA* | Vancomycin 15-20mg/kg IV or 1g IV stat (refer TDM for level) | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Repeat peripheral culture every 48-72h until culture is negative.<br><br>*In MRSA infection, nasal swab for MRSA and decolonization with mupirocin 2% cream plus chlorhexidine 4% bath may be considered. |
| ***Enterococcus*** | Ampicillin 1-2g IV q12-24h<br>**OR**<br>Vancomycin 15-20mg/kg IV or 1g IV stat (refer TDM for level) | Linezolid 600mg IV q12h | The choice of antibiotic should be tailored to the culture and sensitivity results. |
| ***Coagulase-negative staphylococci (CoNS)***<br><br>Methicillin-sensitive | Cefazolin 2g IV stat and 1g IV q24h | | In the absence of endovascular hardware (e.g. cardiac implant, foreign material in the body), only consider antibiotics if fever and/or bacteraemia persists after catheter removal.<br><br>Duration:<br>- If catheter is removed, for 5 to 7 days<br>- If catheter salvage is necessary, for 14 days and repeat cultures for confirmation |
| Methicillin-resistant | Vancomycin 15-20mg/kg IV or 1g IV stat (refer TDM for level) | | |
| ***Corynebacterium, Bacillus, Micrococcus*** | Vancomycin 15-20mg/kg or 1g IV stat (refer TDM for level) | | Duration: 2 weeks<br>The necessity of antibiotic therapy has to correlate with clinical infection. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Gram-negative bacilli**<br><br>Uncomplicated<br>(e.g. *Klebsiella pneumoniae*, *E. coli*)<br><br>*Pseudomonas* spp.* | Ceftazidime 2g IV stat and 1g IV q24h | | Duration: 2 weeks<br><br>*May consider a combination of antibiotics if suspected *Pseudomonas* spp. Infection.<br><br>The choice of antibiotic should be tailored to the culture and sensitivity results. |
| *Burkholderia cepacia* | Trimethoprim/sulfamethoxazole<br>2.5-5mg/kg (TMP component) IV q24h | | |
| ***Candida* species** | Fluconazole 200mg IV q24h* | | *Except *Candida krusei* and *Candida glabrata*<br><br>Duration: 14 days after first negative culture |

Catheter removal is preferred especially if:
(i) metastatic infection – septic arthritis, endocarditis (4-6 weeks antibiotics); osteomyelitis (6-8 weeks antibiotics)
(ii) *S. aureus*, MDR organisms or fungal infection
(iii) tunnel infection
(iv) clinical picture not improving or repeated blood cultures remain positive

If catheter removal is undesirable, for guidewire catheter exchange (after 72 hours of appropriate antibiotics)

**References:**


1. Mermel LA, Allon M, Bouza E, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Disease Society of America. Clin Infect Dis. 2009;49:1-45
2. Abad CL, Safdar N. Catheter-related bloodstream infection. IDSE Special edition 2011.
3. Vanholder R, Canaud B, Fluck R *et al*. Diagnosis, prevention and treatment of haemodialysis catheter-related bloodstream infections (CRBSI): a position statement of European Renal Best Practice (ERBP). NDT Plus 2010;3:234-46.
4. Band JD. Treatment of intravascular catheter-related infections. In: UpToDate. (Accessed on October 18, 2017.)

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **B. PERITONITIS** | | | |
| **CAPD Peritonitis**<br>*S. aureus*<br>CoNS<br>*Pseudomonas aeruginosa*<br>Gram-negative enterics | **First line:**<br>*For anuric patients:*<br>Cefepime 1g IP loading, then 250mg IP q6h<br><br>*For oliguric patients:*<br>Cefepime 1.25g IP loading, then 250/250/250/500mg IP q6h<br><br>**PLUS**<br>Antifungal prophylaxis: Nystatin suspension 500,000 unit PO q6h<br><br>If no response,<br>**Second line:**<br>Continue Cefepime IP,<br>**add** Amikacin 125mg IP ON<br><br>**PLUS**<br>Antifungal prophylaxis: Fluconazole 100-200mg PO q24h<br><br>**Third line:**<br>Discontinue Cefepime IP, continue Amikacin IP<br>**add** Imipenem 500mg IP loading, then 100mg IP q6h<br>**add** Vancomycin 1.5g IP loading, then 100mg IP q6h (anuric) or 125mg IP q6h (oliguric) | **First line:**<br>Cloxacillin 1g IP loading, then 250mg IP q6h<br>**OR**<br>Cefazolin 1g IP loading, then 250mg IP q6h<br><br>**PLUS**<br>Ceftazidime 1g IP loading, then 250mg IP q6h<br><br>**PLUS**<br>Antifungal prophylaxis: Nystatin suspension 500,000 unit PO q6h | Prolonged courses of intraperitoneal aminoglycosides should be avoided.<br><br>Adjunctive oral N-acetylcysteine therapy may help prevent aminoglycoside ototoxicity.<br><br>Stability and compatibility of antibiotics in dextrose-based PD solution **under room temperature:**<br>- Cefazolin - 8 days (7 days in Icodextrin)<br>- Ceftazidime - 4 days (2 days in Icodextrin)<br>- Vancomycin - 28 days (14 days in Icodextrin)<br>- Cefepime, Amikacin, Imipenem - no data<br><br>Aminoglycosides and penicillins should not be added to the same bag due to chemical incompatibility. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **PLUS**<br>Antifungal prophylaxis: Fluconazole 100-200mg PO q24h | | |

**References:**
1. ISPD Peritonitis Guideline Recommendations: 2022 Update on Prevention and Treatment. *Peritoneal Dialysis International,* Vol. 42(2), pp. 110–153
2. CPG RRT 2017 pg 236-237

# CHEMOPROPHYLAXIS

## A. SURGICAL CHEMOPROPHYLAXIS

The goal of antibiotic prophylaxis is to prevent surgical site infection by reducing the burden of microorganisms at the surgical site during the operative procedure.

Single-dose prophylaxis is usually sufficient. If antibiotic prophylaxis is continued post-operatively, the duration should be less than 24 hours (up to 48 hours for cardiac surgery), regardless of the presence of intravascular catheters or indwelling drains.

If there are pre-existing infections (known or suspected), use appropriate treatment regimen instead of prophylactic regimen for procedure. However, re-dosing is required just prior to skin incision.

The optimal time for administration of pre-operative antibiotics is 60 minutes prior to surgical incision. Some agents, such as fluoroquinolones and vancomycin, require administration over one to two hours. Hence, the administration of these agents should begin within 120 minutes before surgical incision.

For patients with penicillin allergy, vancomycin or clindamycin is recommended unless stated otherwise.

An additional dose of prophylactic antibiotic during operation is indicated if:

- excessive blood loss (>1500 mL)
- procedures exceed two half-lives of the drug
- if there are other factors that may shorten the half-life of the prophylactic agent (e.g. extensive burns)

| Antimicrobial | Recommended redosing interval with normal renal function (from initiation of preoperative dose), hr |
|---|---|
| Amoxicillin/clavulanate | 3 |
| Ampicillin/sulbactam | 2 |
| Benzylpenicillin | 2 |
| Cefazolin | 4 |
| Cefuroxime | 4 |
| Clindamycin | 6 |
| Gentamicin | NA |
| Metronidazole | NA |
| Vancomycin | NA |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **1. OBSTETRICS & GYNAECOLOGY** | | | |
| **A. Obstetrics** | | | |
| Caesarean section<br>a. Elective<br>b. Emergency | Cefazolin 2g IV*<br>**OR**<br>Cefuroxime 1.5g IV<br><br>**PLUS/MINUS**<br>Metronidazole 500mg IV | Ampicillin/sulbactam 3g IV<br><br>**In patients with severe penicillin/cephalosporin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV<br>(If overweight or obese, based on adjusted body weight) | *Cefazolin 3g IV for patients weighing ≥120 kg<br>Cefazolin 1g IV for patients weighing <80 kg<br><br>**Clinical judgement is needed to evaluate a different regimen (higher dose, second dose) of prophylactic antibiotics in the presence of risk factors:<br>- High BMI<br>- Prolonged labour<br>- Prolonged duration of surgery<br>- Extensive surgical manipulation<br>- Massive blood loss<br><br>***May be omitted if the patient is already receiving other equivalent broad spectrum antibiotics for other indications. |
| Manual removal of placenta | Cefazolin 2g IV*<br>**OR**<br>Cefuroxime 1.5g IV<br><br>**PLUS** | Ampicillin/sulbactam 3g IV<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV | As a single dose |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | Metronidazole 500mg IV | **In patients with severe penicillin/cephalosporin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV | |
| Repair of perineal tear:<br>- First/second degree tears (including episiotomy repairs) | Antibiotic not indicated | | |
| Repair of perineal tear:<br>- Third or fourth degree tears | Cefazolin 2g IV*<br>**OR**<br>Cefuroxime 1.5g IV<br><br>**PLUS**<br>Metronidazole 500mg IV | Ampicillin/sulbactam 3g IV<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV<br><br>**In patients with severe penicillin/cephalosporin allergy:**<br>Gentamicin 5mg/kg IV<br>**PLUS**<br>Metronidazole 500mg IV | Duration: 5-7 days |
| Cervical cerclage | Current evidence insufficient to recommend for or against antibiotics prophylaxis | | |
| Operative vaginal delivery (forceps/vacuum-assisted delivery) | Amoxicillin/clavulanate 1.2g IV | | As a single dose |
| **B. Gynaecology** | | | |
| Laparotomy: Hysterectomy | Cefazolin 2g IV*<br>**OR** | Ampicillin/sulbactam 3g IV<br>**OR** | Consider to give second or additional dose for: |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Laparoscopic: Hysterectomy (TLH/LAVH) or when need to access uterine cavity/vagina<br>Vaginal Hysterectomy | Cefuroxime 1.5g IV<br><br>**PLUS**<br>Metronidazole 500mg IV | Amoxicillin/clavulanate 1.2g IV<br><br>**In patients with severe penicillin/cephalosporin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV | - prolonged procedures (>3 hours)<br>- blood loss >1500ml |
| Laparotomy: lymphadenectomy, omentectomy, cystectomy, oophorectomy, myomectomy, salpingectomy/tubal ligation (without entry into bowel/vagina) | Cefazolin 2g IV*<br>**OR**<br>Cefuroxime 1.5g IV<br><br>**PLUS/MINUS**<br>Metronidazole 500mg IV | Ampicillin/sulbactam 3g IV<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV<br><br>**In patients with severe penicillin/cephalosporin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV | |
| Laparoscopic surgery – without breaching bowel/uterine/vaginal cavity | Antibiotic not recommended | | |
| Surgical termination of pregnancy | Antibiotic not indicated | | |
| Hysteroscopy | Antibiotic not indicated | | |
| Urogynaecology procedures (urethral sling/TVT, colposuspension, vaginal | Cefazolin 2g IV*<br>**OR**<br>Cefuroxime 1.5g IV | Ampicillin/sulbactam 3g IV<br>**OR**<br>Amoxicillin/clavulanate 1.2g IV | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| prolapse surgery +/- mesh/SSF) | **PLUS**<br>Metronidazole 500mg IV | **In patients with severe penicillin/cephalosporin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV | |
| Large loop excision of transformation zone/knife cone biopsy | Current evidence insufficient to recommend for or against antibiotics prophylaxis | | |
| Transvaginal oocyte retrieval | Doxycycline 200mg PO | | |

**References:**


1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health-Syst Pharm.* 2013; 70:195-283
2. Van Eyk N, van Schalkwyk J, Infectious Diseases Committee. J ObstetGynaecol Can. 2012 Apr; 34(4):382-391.
3. Van Schalkwyk J, Van Eyk N et al. No 247 – Antibiotic Prophylaxis in Obstetric Procedures.
4. Journal of Obstetrics and Gynaecology Canada, Volume 39, Issue 9, September 2017, Pages e300-e308.
5. WHO recommendation on prophylactic antibiotics for women undergoing caesarean section. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IG
6. National Antimicrobial Guideline 2019. Ministry of Health Malaysia
7. The management of third- and fourth-degree perineal tears. Greentop Guideline No 29, June 2015; Royal College of Obstetricians & Gynaecologist
8. ACOG practice bulletin No 195: Prevention of infection after gynecologic procedures. Obstet Gynecol 2018; 131: e172
9. ACOG practice bulletin No. 199: Use of prophylactic antibiotics in labour and delivery. Obstet Gynecol 2018;132: e103
10. WHO guidelines for the management of postpartum haemorrhage and retained placenta, 2009
11. Surgical Antibiotic Prophylaxis Guideline 2020. The Women's, The Royal Women's Hospital, Victoria, Australia.
12. Ekanem EE, Oniya O, Saleh H, Konje JC. Surgical site infection in obstetrics and gynaecology: prevention and management. The Obstetrician & Gynaecologist 2021; 23:124-37. https//doi.org/10.1111/tog.12730
13. HCTM PPUKM. Surgical Prophylaxis Guide 2018
14. Prophylactic antibiotics in the prevention of infection after operative vaginal delivery (ANODE): a multicentre RCT; Lancet 2019;393:2395-403

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| 15. Weinreb et al. Should all oocyte donors receive prophylactic antibiotics for retrieval?; Fertility and Sterility Vol 94.No 7.Dec 2010 American Society for Reproductive Medicine. | | | |
| **2. OTORHINOLARYNGOLOGY SURGERY** | | | |
| **Head and neck** | | | |
| Clean | Antibiotic not required | Antibiotic not required | |
| Clean with placement of prosthesis (excludes tympanostomy tubes) | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV | Duration:<br>● One dose prior to skin incision<br>● Post-operative duration variable depending on individual cases |
| Clean-contaminated cancer surgery<br>Other clean-contaminated procedures with the exception of tonsillectomy and functional endoscopic sinus procedures | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br><br>Cefazolin 2g IV (3g IV for patients weighing ≥120 kg)<br>**PLUS**<br>Metronidazole 500mg IV | Cefuroxime 1.5g IV<br>**PLUS**<br>Metronidazole 500mg IV | Duration:<br>● One dose prior to skin incision<br>● Post-operative duration variable depending on individual cases |

**References:**


1. Simo R, French G. The use of prophylactic antibiotics in head and neck oncological surgery. *CurrOpinOtolaryngolHead Neck Surg*. 2006; 14:55-61 88
2. Surgical Prophylaxis Guide 2018, HUKM.
3. Vander Poorten V, Uyttebroek S, Robbins KT et al. Perioperative antibiotics in clean-contaminated head and neck surgery: a systematic review and meta-analysis. Adv Ther. 2020;37(4):1360-1380.
4. Iocca O, Copelli C, Ramieri G et al. Antibiotic prophylaxis in head and neck cancer surgery: systematic review and Bayesian network meta-analysis. Head Neck. 2022;44(1):254-261.


**3. ORAL/DENTAL SURGERY**

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| Clean surgery (Class 1)<br>- Submandibular gland surgery<br>- TMJ surgery<br>- Excision of benign tumousr/cysts<br><br>Minor clean-contaminated surgery (Class 2)<br>- Soft tissue surgery<br>- Dentoalveolar surgery*<br>- Periodontal surgery | Not indicated for most surgeries<br><br>May be indicated<br>i. if the duration of the surgery is expected to be very long<br>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<br><br>*In patients with cardiac conditions with increased risk of infective Endocarditis, chemoprophylaxis is indicated.<br>Please refer to the Non-Surgical Antibiotic Prophylaxis section. |
| Minor Clean-contaminated surgery (Class 2)<br>- insertion of dental implants and use of graft material<br>- high degree of difficulty/long duration | Amoxicillin 1g PO<br>**OR**<br>Clindamycin 600-900mg IV/PO<br>**OR**<br>Benzylpenicillin 2MU IV | Amoxicillin/clavulanate 1.2g IV or 1.25g PO<br>**OR**<br>Cefuroxime 1.5g IV or 500mg PO | |
| Major clean-contaminated surgery (Class 3)<br>- Orthognathic surgery<br>- Excision / enucleation of large benign tumours/cysts<br>- All oral cancer surgery<br>- Open reduction and internal fixation of facial bone fractures | Benzylpenicillin 2MU IV<br>**OR**<br>Clindamycin 600-900mg IV | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Cefuroxime 1.5g IV | For oral and maxillofacial fractures, antibiotics are recommended for the immediate post-trauma period and should be discontinued once open reduction and internal fixation are completed. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Reference:**<br>1. Oral Health Division Ministry of Health Malaysia. Antibiotic Prophylaxis in Oral Surgery for Prevention of Surgical Site Infection. Putrajaya: Dental Technology Section Oral Health Division (OHD) Ministry of Health Malaysia; 2015. | | | |
| **4. PLASTIC SURGERY** | | | |
| Not indicated: for the majority of clean procedures, unless the patient has risk factors for postoperative infection (e.g. implantation of prosthetic material, prior skin irradiation). The continuation of antibiotics while waiting for non-infected skin grafts or flaps to epithelialize is not evidence-based. | | | |
| For clean-contaminated procedures | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Amoxicillin/clavulanate 1.2g IV | |
| **Reference:**<br>1. Antibiotic Expert Groups. Therapeutic guidelines: antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014. | | | |
| **5. VASCULAR SURGERY** | | | |
| Amputation of ischemic limb<br><br>Suspected organisms: *Staphylococcus* spp. & anaerobic organisms | Ampicillin/sulbactam 3g IV | Amoxicillin/clavulanate 1.2gm IV | |
| Open and endovascular repair of abdominal aneurysm | Amoxicillin/clavulanate 1.2g IV | **Penicillin allergy:**<br>Vancomycin 1g IV (1.5g IV for patients weighing ≥ 75 kg) | |
| Bypass surgery | Amoxicillin/clavulanate 1.2g IV | **Penicillin allergy:**<br>Vancomycin 1g IV (1.5g IV for patients weighing ≥ 75 kg) | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Arteriovenous graft | Amoxicillin/clavulanate 1.2g IV<br><br>**If high risk for MRSA:**<br>Vancomycin 1g IV (1.5g IV for patients weighing ≥ 75 kg) | | MRSA risk – defined as history of MRSA colonisation or infection **OR** inpatient of high-risk hospital or unit (where MRSA is endemic). |
| **Reference:**<br>1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm.2013; 70:195-283 | | | |
| **6. GENERAL SURGERY** | | | |
| Procedures involving entry into lumen of gastrointestinal tract (bariatric, pancreaticoduodenectomy) | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV | |
| Procedures without entry into gastrointestinal tract (antireflux, highly selective vagotomy) for high-risk patients | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV | |
| Appendectomy for uncomplicated appendicitis<br><br>Colorectal | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg)<br>**PLUS**<br>Metronidazole 500mg IV<br><br>**OR**<br>Ampicillin/sulbactam 3g IV | Cefuroxime 1.5g IV<br>**PLUS**<br>Metronidazole 500mg IV<br><br>**Penicillin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg | For patients undergoing elective colorectal surgery, a mechanical bowel preparation combined with neomycin PO **PLUS** erythromycin PO **OR** neomycin PO **PLUS** metronidazole PO should be given along with intravenous antibiotic prophylaxis.<br><br>**<u>Preferred regimen:</u>**<br>Neomycin 1g PO<br>**PLUS**<br>Metronidazole 400mg PO |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | for 2-3 doses in conjunction with mechanical bowel preparation<br>*Preferred timing for 2 doses: 3:00 p.m. and 7:00 p.m. (after administration of oral bowel preparation) |
| Small intestine | **Non-obstructed:**<br>Cefazolin 2g IV (3gm IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV<br><br>**Penicillin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg IV | |
| | **Obstructed:**<br>Cefazolin 2g IV (3g IV for patients weighing ≥120 kg)<br>**PLUS**<br>Metronidazole 500mg IV | Cefuroxime 1.5g IV<br>**PLUS**<br>Metronidazole 500mg IV<br><br>**Penicillin allergy:**<br>Clindamycin 600-900mg IV<br>**PLUS**<br>Gentamicin 5mg/kg | |
| Hernia repair with mesh | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Ampicillin/sulbactam 3g IV | Includes laparoscopic repair. |
| Breast cancer surgery | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Ampicillin/sulbactam 3g IV | The benefits of routine postoperative antibiotic doses in reconstruction surgery are uncertain; there may be a benefit in obese patients or those treated with radiation therapy. The need for postoperative doses should be considered on an individual patient |
| Breast reshaping procedures | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Ampicillin/sulbactam 3g IV | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | basis; if used, postoperative prophylaxis should not exceed 24 hours.[2] |
| Breast surgery with implant (reconstructive or aesthetic) | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Ampicillin/sulbactam 3g IV | |
| **References:**<br>1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm. 2013; 70:195-283<br>2. Antibiotic Expert Groups. Therapeutic guidelines: antibiotic. Version 15. Melbourne: Therapeutic Guidelines Limited; 2014.<br>3. Rollins KE, Javanmard-Emamghissi H, Acheson AG and Lobo DN. The role of oral antibiotic preparation in elective colorectal surgery. Annals of Surgery. 2019; 270(1), 43–58.<br>4. Kelleher DC, Sigle GW and Kumar AS. Bowel preparation before elective surgery. Clinics in Colon and Rectal Surgery. 2013; 26(03): 146–152. | | | |
| **7. ORTHOPAEDIC SURGERY** | | | |
| Clean operations involving hand, knee, or foot and not involving implantation of foreign materials | None | | |
| Internal fixation of all closed fracture/total joint replacement/spine surgery (with and without instrumentation)/Arthroscopy | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV<br><br>**Penicillin allergy:**<br>Clindamycin 600-900mg IV | The benefits of routine postoperative antibiotics are uncertain. If used, postoperative prophylaxis should not exceed 24 hours. |
| **References:**<br>1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm.2013; 70:195-283<br>2. T.P Ruedi ,R.GBuckley,C.GMarani,AO principle of fracture management. A.H.R.W Simpson, BMJ 2015 | | | |
| **8. UROLOGY SURGERY** | | | |
| **A. Diagnostic Procedures** | | | |
| Transrectal ultrasound and prostate biopsy | Ciprofloxacin 500mg PO q12h for 3 days (start 24 hours before procedure)<br>**PLUS/MINUS** | Targeted antibiotic therapy based on preoperative rectal swab results. | Consider povidone-iodine bowel preparation to further decrease infection risk. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Common organisms:<br>*Escherichia coli*, *Klebsiella*, *Proteus*, *Enterococcus*, *Pseudomonas* | Gentamicin 80mg IV single dose given 30-60 minutes before procedure. | | |
| Cystoscopy/Urodynamics study | Antibiotic not recommended | | Prophylaxis only for high-risk cases (immunocompromised patients, e.g. debilitated patients on long term catheters, patient with prosthetic/heart valves, diabetics, transplant recipients):<br>Cefuroxime 250mg PO stat.<br><br>If heart valve:<br>Follow recommendation for SBE prophylaxis. |
| Retrograde pyelogram/Ureteral stenting | Cefuroxime 250mg PO stat | | |
| **B. Endourology** | | | |
| Endourological surgery<br>e.g. PCNL, URS, RIRS, TURP<br><br>Common organisms:<br>*Escherichia coli*, *Klebsiella*, *Proteus*, *Enterococcus*, *Pseudomonas* | Amoxicillin/clavulanate 1.2g IV<br>**OR**<br>Ampicillin/sulbactam 3g IV | Cefuroxime 1.5g IV<br>**OR**<br>Ceftazidime 2g IV (if urine grew *Pseudomonas*) | Antibiotic selection to be determined based on the patient's latest urine culture result. |
| **C. Open Surgery** | | | |
| Clean operations<br>e.g. orchidectomy, orchidopexy, varicocelectomy, deroofing renal cysts | Antibiotic not required | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| Clean-contaminated (with opening of urinary tract)<br>e.g. nephrectomy, prostatectomy, open stone surgery.<br><br>Common organisms:<br>*Escherichia coli*, *Klebsiella*, *Proteus*, *Enterococcus*, *Pseudomonas* | Amoxicillin/clavulanate 1.2g IV q8h for 1 day<br>**OR**<br>Ampicillin/sulbactam 3g IV q8h for 1 day | Cefoperazone 1g IV q12h for 1 day<br>**OR**<br>Ceftazidime 2g q8h IV for 1 day (if urine grew *Pseudomonas*) | |
| Clean-contaminated (with use of bowel segments)<br>e.g. cystectomy with urinary diversion, cystoplasty.<br><br>Common organisms:<br>*Escherichia coli*, *Klebsiella*, *Proteus*, *Enterococcus*, *Pseudomonas*, anaerobes | Cefoperazone 1g IV q12h<br>**PLUS**<br>Metronidazole 500mg IV q8h | Gentamicin 1.5mg/kg IV q8h<br>**PLUS**<br>Metronidazole 500mg IV q8h | For duration of catheter presence. |
| Implant of prosthetic devices<br>e.g. insertion of penile prosthesis or artificial urinary sphincter, artificial slings<br><br>Common organism:<br>*Staphylococcus aureus* | Cefuroxime 1.5g IV q8h for 1 week | Amoxicillin/clavulanate 1.2g IV q8h for 1 week<br>**OR**<br>Ampicillin/sulbactam 3g IV q8h for 1 week | |
| Laparoscopic surgery or clean– contaminated | As for open surgery | As for open surgery | Depending on type of procedure performed whether clean |

**Reference:**

1.Pickard R., Bartoletti R., Bjerklund-Johansen TE., Bonkat G., Bruyere F., Cek M. et al. members of the EAU – ESTRO – ESUR –SIOG Urological Infections Guidelines Panel. EAU – ESTRO – ESUR – SIOG Guidelines on Urological Infections. Edn. presented at the EAU Annual Congress London 2017. 978-90-79754-91-5. Publisher: EAU Guidelines Office. Place published: Arnhem, The Netherlands.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **9. CARDIAC SURGERY** | | | |
| Coronary artery bypass | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV | |
| Cardiac device insertion procedures (e.g. pacemaker implantation) | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | Cefuroxime 1.5g IV | |
| **Reference:**<br>1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm.2013; 70:195-283 | | | |
| **10. HEPATOBILIARY SURGERY** | | | |
| **Laparoscopic procedures**<br>Low risk | Cefazolin 2g (3g IV for patients weighing ≥120 kg) | | Optimum antibiotic timing is to complete intravenous infusion ≤60min (optimal window 15 to 45 min) prior to skin incision; to ensure adequate time to reach bactericidal serum and tissue concentration before skin is incised.<br><br>Repeat intraoperative dosing is recommended in:<br>• Prolonged surgery > 4 hours<br>• Massive blood loss > 1.5 L<br><br>*Aminoglycosides should not be re-dosed. |
| **Laparoscopic procedures**<br>High risk:<br>Stent insertion<br>Biliary obstruction (high direct bilirubin) | Cefazolin 2g (3g IV for patients weighing ≥120 kg)<br>**PLUS**<br>*Gentamicin 5mg/kg IV (2mg/kg IV single dose if CrCl< 20) | | |
| **Open surgery**<br>Low risk | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | | |
| **Open surgery**<br>High risk | Cefazolin 2g IV (3g IV for patients weighing ≥120 kg) | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Multiple ERCP ( ≥ 2) done with stenting<br>Biliary obstruction<br>Biliary infection or surgery within < 30 days | **PLUS**<br>Gentamicin 5mg/kg IV (2mg/kg IV single dose if CrCl< 20)<br><br>If high risk ESBL/multi-resistant organisms, e.g. ESBL in the last 3 months but treated<br><br>Piperacillin/tazobactam 4.5g IV<br>**PLUS**<br>Gentamicin 5mg/kg IV (2mg/kg IV single dose if CrCl< 20) | | |
| **Pre-existing infection before surgery, gallbladder empyema, ascending cholangitis** | Initiate antibiotics according to culture results, or refer to treatment guidelines.<br><br>If patient is at risk of infection with multidrug resistant organism, to discuss with consultant surgeons/ID physicians | | |
| **Reference:**<br>1. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm.2013; 70:195-283 | | | |
| **11. NEUROLOGICAL SURGERY** | | | |
| **Clean wounds**<br>(Uninfected operative wounds in which no inflammation is encountered and no viscus is entered during the procedures)<br><br>- Elective craniotomy or spinal procedures | Cefuroxime 1.5g IV<br>(Given as a single IV dose at induction or within 60 minutes before incision. For prolonged procedures, additional intraoperative doses are given at every 4 hours interval during surgery in patients with normal renal function) | Vancomycin 15-20mg/kg IV (max 2g)<br>(Infusion is started within 60-120 minutes before incision. Additional redose interval is at every 12 hours during surgery in patients with normal renal function) | Situations where the use of vancomycin is appropriate:-<br>● In hospitals in which MRSA or *S. epidermidis* is the frequent cause of postoperative wound infection,<br>● In patients previously colonised with MRSA, or<br>● Those who are allergic to penicillins or cephalosporins. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Rapid IV administration of vancomycin may cause hypotension. |
| **Clean wounds with foreign body or instrumentation**<br>- CSF shunting procedures, implantation of cranial or spinal implants | Cefuroxime 1.5g IV<br>**PLUS**<br>Metronidazole 500mg IV<br>(Given as a single IV dose at induction or within 60 minutes before incision. Additional redose interval is at every 4 hours during surgery in patients with normal renal function) | Vancomycin 15-20mg/kg IV (max 2g)<br>**PLUS**<br>Gentamicin 5mg/kg IV<br>(Given as a single IV dose at induction or within 60 minutes before incision in patients with normal renal function)<br>**PLUS**<br>Metronidazole 500mg IV | Addition of another drug such as metronidazole and aminoglycoside is appropriate for procedures in which enteric gram-negative bacilli or anaerobes are common pathogens. |
| **Clean-contaminated wounds**<br>(Operative wounds in which a viscus is entered and without unusual contaminations)<br><br>- Procedures that breach air cells or nasal or oral cavity | Cefuroxime 1.5g IV<br>**PLUS**<br>Metronidazole 500mg IV | Vancomycin 15-20mg/kg IV (max 2g)<br>**PLUS**<br>Gentamicin 5mg/kg IV<br>**PLUS**<br>Metronidazole 500mg IV | |
| **Contaminated wounds**<br>(Open, fresh accidental wounds, operation with major breaks in sterile technique, or gross spillage from a viscus) | Ceftriaxone 2g IV<br>(Given as a single IV dose at induction or within 60 minutes before incision. Additional redose interval is at every 12 hours during surgery in patients with normal renal function)<br>**PLUS**<br>Metronidazole 500mg IV | Vancomycin 15-20mg/kg IV (max 2g)<br>**PLUS**<br>Gentamicin 5mg/kg IV<br>**PLUS**<br>Metronidazole 500mg IV | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | |
| **Dirty wounds**<br>(Infected CSF shunt, old traumatic wounds with retained devitalized tissue, foreign bodies or wounds that involve existing clinical infection or perforated viscus) | Ceftriaxone 2g IV<br>**PLUS**<br>Metronidazole 500mg IV | Vancomycin 15-20mg/kg IV (max 2g)<br>**PLUS**<br>Gentamicin 5mg/kg IV<br>**PLUS**<br>Metronidazole 500mg IV | Settings where intraventricular antibiotics (Vancomycin 10mg or Gentamicin 5mg) may be useful:<br>● Failure to sterilise the CSF with IV therapy<br>● Poor response to systemic IV antibiotics<br>● Presence of highly resistant organisms susceptible to only antibiotics with poor CSF penetration<br>● Circumstances in which shunt devices cannot be removed (including infected Ommaya reservoir) |

**References:**


1. Salford Royal, NHS. Antibiotic Prophylaxis in Cranial Neurosurgery Antibiotic Guidelines, Unique ID: 144TD(C)25(F4) Issue number: 6, 2018
2. SIGN 104 Antibiotic prophylaxis in surgery. July 2008, updated April 2014
3. Surgical Antimicrobial Prophylaxis Clinical Guideline v2.0. Department for Health and Ageing, Government of South Australia. October 2017


**12. OPHTHALMOLOGY**

- The use of povidone iodine 10% to the periorbital skin and 5% to the conjunctival sac as an antiseptic agent for preoperative surgical site preparations are 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.
- Topical antibiotics at the end of surgery.

**Reference:**


1. Prophylaxis for intraocular surgery-CPG for Management of Post-Operative Endophthalmitis, Ministry of Health Malaysia, August 2006

## B. NON-SURGICAL CHEMOPROPHYLAXIS

Patients with cardiac conditions listed in Table 1 are considered as being at increased risk of developing infective endocarditis (IE) and are indicated for antibiotic prophylaxis prior to certain procedures.

| **Table 1: Cardiac conditions with increased risk of IE** |
|---|
| ● Prosthetic cardiac valves or prosthetic material used for cardiac valve repair<br>● Established rheumatic heart disease<br>● Previous history of IE<br>● Unrepaired cyanotic congenital heart disease (CHD), including palliative shunts and conduits<br>● Completely repaired CHD with prosthetic material or devices, for first 6 months after the procedure<br>● Repaired CHD with residual defects at the site or adjacent to the site of the prosthetic device (which inhibit endothelisation)<br>● Cardiac transplantation recipients who develop cardiac valvulopathy |

**Dental procedures**

For patients considered as high risk (Table 1), antibiotic prophylaxis is recommended for invasive dental procedures involving manipulation of gingival tissue or the periapical region of the teeth or perforation of the gingival mucosa.

Even with high cardiac risk of IE, antibiotic prophylaxis is not recommended for:
- local anaesthetic injections in non-infected tissues
- treatment of superficial caries
- removal of sutures
- dental X-rays
- placement or adjustment of removable prosthodontic or orthodontic appliances or braces
- following the shedding of deciduous teeth
- trauma to the lips and oral mucosa

**Non-dental procedures**

| **Table 2: Non-dental procedures and recommendations for antibiotic prophylaxis in patients with increased risk of IE** | | |
|---|---|---|
| **Respiratory tract procedures** | **Gastrointestinal and genitourinary procedures** | **Dermatological or musculoskeletal procedures** |
| ● Antimicrobial prophylaxis is recommended for patients with increased risk of IE (Table 1) who undergo an invasive respiratory tract procedure that involve incision or biopsy of the respiratory mucosa.<br>● Patients who undergo an invasive respiratory tract procedure to treat an established infection, e.g. biopsy drainage of an abscess, should receive an antibiotic prophylaxis which contains an anti-staphylococcal agent. | ● Routine pre-procedural antibiotic prophylaxis is no longer recommended for patients undergoing genitourinary or gastrointestinal tract procedures.<br>● However, for patients with increased risk of IE (Table 1) who have an established gastrointestinal or genitourinary infection, or for those who receive antibiotic therapy for surgical reasons, the antibiotic regimen should include an agent active against enterococci, such as ampicillin or vancomycin. | ● For patients described in Table 1 undergoing surgical procedures involving infected skin (including local abscesses), skin structure or musculoskeletal tissue, it is reasonable that the therapeutic regimen contains an agent active against staphylococci and beta-hemolytic streptococci. Vancomycin or clindamycin may be used in patients unable to tolerate a β-lactam antibiotic.<br>● If the infection is known or suspected to be caused by MRSA, vancomycin or another suitable agent should be administered. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Prophylactic regimens for high-risk dental procedures in high-risk patients** | | | |
| Prophylactic regimen | Amoxicillin 2g PO<br>**OR**<br>Ampicillin 2g IV | Cefazolin 1g IV<br><br>**Penicillin allergy:**<br>Clindamycin 600mg IV/PO | See above for antibiotic prophylaxis in patients undergoing invasive surgical procedure to treat an established infection.<br><br>Antibiotic to be administered as a single dose 30 to 60 minutes before procedure. |
| **Secondary prevention of rheumatic fever** | | | |
| Secondary prevention of rheumatic fever | Benzathine benzylpenicillin 1.2MU IM every 3 to 4 weeks<br>**OR**<br>Phenoxymethylpenicillin (Penicillin V) 250mg PO q12h | **Penicillin allergy:**<br>Erythromycin Ethylsuccinate 800mg PO q12h | *Duration of prophylaxis please refer to the table below* |

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

**References:**


1. Ministry of Health Malaysia's Clinical Practice Guidelines For The Prevention, Diagnosis & Management Of Infective Endocarditis 2017
2. ESC Guidelines on Prevention of Infective Endocarditis 2015
3. The 2020 Australian Guideline for Prevention, Diagnosis and Management of Acute Rheumatic Fever and Rheumatic Heart Disease (3.2 Edition, March 2022)

# (SECTION B: PAEDIATRICS)

*Doses of recommended antimicrobials are not included in this section.*
*Please refer to relevant references for dosage recommendations*

## CARDIOVASCULAR INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **ACUTE MYOCARDITIS** | | | |
| Viral (commonest cause)<br><br>Enteroviruses<br>Adenovirus<br>Influenza<br>HIV etc | Treatment mainly supportive | | Among the viruses implicated are enteroviruses including Coxsackie & EV71. For severe HFMD with cardiopulmonary failure stage, use of IVIG may be considered if not used during CNS involvement or autonomic nervous system dysregulation stage. |
| **ACUTE PERICARDITIS** | | | |
| Viral (commonest cause)<br><br>Bacterial:<br>*Staphylococcus aureus*<br>*Haemophilus influenza*<br>*Salmonella* spp.<br>*M.Tuberculosis* | Treatment mainly supportive<br><br>**Empiric for purulent pericarditis:**<br><br>IV Cloxacillin<br>**PLUS**<br>IV Cefotaxime | <br><br>**<u>Antibiotic allergy:</u>**<br>IV Cefazolin | Need pericardial fluid to differentiate between different etiologic agents and C&S to adjust antibiotics. Consider surgical drainage for tamponade, pre-tamponade & ineffective conservative management.<br><br>Duration of therapy: 4 weeks |
| **INFECTIVE ENDOCARDITIS** | | | |
| **Empirical Therapy for Infective Endocarditis** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Community-acquired organisms:**<br>*Streptococcus, Enterococcus*<br>HACEK Gram-negative organisms | IV Ampicillin<br>**PLUS**<br>IV Gentamicin | **PLUS/MINUS**<br>*IV Cloxacillin | *For acute presentation, need to cover for MSSA since *Streptococcus* & *Enterococcus* HACEK presentations are usually sub-acute. |
| **Healthcare-associated organisms:**<br>MRSA<br>Non-HACEK Gram-negative organisms<br>*Enterococcus sp.* | IV Vancomycin<br>**PLUS**<br>IV Gentamicin<br><br>**PLUS/MINUS**<br>*Rifampicin | | *Rifampicin is ONLY for prosthetic valve AND added 3-5 days later than vancomycin & gentamicin<br><br>If non-HACEK Gram-negative organisms like pseudomonas are suspected epidemiologically, add cefepime until cultures are known.<br><br>Once cultures are available, adjust accordingly. |
| **Specific Organisms:** | | | |
| **1. Infective endocarditis *(Streptococcus viridans*)** | | | |
| Strains fully susceptible to penicillin (MIC<0.125 mg/L) | IV Benzylpenicillin | IV Ampicillin<br>**OR**<br>IV Ceftriaxone<br>**OR**<br>**<u>Antibiotic allergy</u>**<br>*IV Vancomycin | Duration:<br>-4 weeks for native valve<br>-6 weeks for prosthetic valve<br><br>Vancomycin dose adjusted for trough concentration of 10-15mg/ml<br><br>*Vancomycin therapy is recommended only for patients |
| Strains with MIC > 0.125 to 2mg/L | IV Benzylpenicillin<br>**PLUS** | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | IV Gentamicin for 2 weeks (add to first line regimen of penicillin/ceftriaxone)<br><br>**Do not use ampicillin** | | with immediate type penicillin hypersensitivity.<br><br>For this strain (MIC>0.125):<br>Antibiotics of choice are either penicillin with gentamicin or ceftriaxone with gentamicin. |
| **2. Infective Endocarditis *(Enterococcus sp.*)** | | | |
| Penicillin-sensitive<br>( MIC≤ 8mg/L) | IV Ampicillin for *4-6 weeks<br>**PLUS**<br>IV Gentamicin for *2-6 weeks | IV Ampicillin<br>**PLUS**<br>IV Ceftriaxone | *Duration:<br>-If symptoms less than 3 months & native valve: ampicillin for 4 weeks & gentamicin for 2 weeks<br>-If symptoms more than 3 months: ampicillin & gentamicin for 6 weeks<br><br>Ampicillin plus ceftriaxone is preferred for individuals with renal impairment (CrCl ≤ 50ml/min) ONLY.<br><br>Cannot use ceftriaxone alone since enterococcus is intrinsically resistant to this drug.<br><br>This combination is NOT ACTIVE against *E. faecium.*<br><br>**Maximum dose of vancomycin: 2g/day unless not able to achieve therapeutic range. Aim for serum trough of 10-20mg/L. |
| Sensitive to penicillin & vancomycin but high-level resistance to gentamicin.<br>(MIC > 500mg/L) | IV Ampicillin<br>**PLUS**<br>IV Ceftriaxone<br><br>Duration : 6 weeks | | |
| Resistant to penicillin but susceptible to vancomycin & gentamicin | **IV Vancomycin<br>**PLUS**<br>IV Gentamicin<br><br>Duration : 6 weeks | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **3. Infective Endocarditis *(Staphylococcus aureus*)** | | | |
| Methicillin-sensitive (left-sided) | IV Cloxacillin for 4-6 weeks | **<u>Antibiotic allergy</u>**<br>IV Cefazolin for 4-6 weeks<br>**OR**<br>IV Vancomycin for 4-6 weeks. | If allergy to penicillin but not immediate type hypersensitivity, use cefazolin.<br><br>Methicillin-sensitive (right sided): can shorten duration to 2 weeks if good response, no metastatic sites, no cardiac or extracardiac complications with size of vegetation less than 20mm. |
| Methicillin-sensitive (right-sided) | IV Cloxacillin for 4 weeks | | |
| Methicillin-resistant (left & right) | IV Vancomycin for 4-6 weeks | IV Daptomycin for 4-6 weeks | Daptomycin is superior to vancomycin for MRSA bacteremia with MIC >1mg/L. |
| Methicillin-sensitive (prosthetic valve) | IV Cloxacillin for ≥6 weeks<br>**PLUS**<br>IV Gentamicin for 2 weeks<br>**PLUS**<br>*****PO Rifampicin ≥6 weeks | | *Rifampicin has better penetration but to protect against development of resistance, use only after 3-5 days of cloxacillin and/or bacteremia has been cleared.<br><br>MRSA (prosthetic valve): Vancomycin & rifampicin for 6 weeks or more. |
| Methicillin-resistant (prosthetic valve) | IV Vancomycin ≥6 weeks<br>**PLUS**<br>IV Gentamicin for 2 weeks<br>**PLUS**<br>*****PO Rifampicin ≥6 weeks | | |
| **4. Culture-negative endocarditis** | IV Ampicillin/sulbactam for 4-6 weeks<br>**PLUS**<br>IV Gentamicin for 4-6 weeks | | Culture-negative endocarditis (CNE) is diagnosed when a child has clinical |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | & echocardiogram evidence of IE but persistent negative cultures.<br><br>This is in individuals with no prior antimicrobial use.<br>If fungi or fastidious organisms are suspected, need to ask microbiologist to prolong incubation.<br><br>Patients with culture-negative endocarditis should be treated in consultation with an ID specialist. |

**References:**


1. American Academy of Paediatrics. Committee on Infectious Diseases. Red Book: Report of the Committee on Infectious Diseases (2018)
2. Malaysia Clinical Practice Guideline for the Prevention, Diagnosis and Management of Infective Endocarditis 2017

## CENTRAL NERVOUS INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Meningitis empirical treatment** | | | |
| **Age group:**<br>**1-3 months:**<br>*Group B streptococcus (GBS), E. Coli, S. pneumoniae & N. meningitidis*<br><br>**> 3months:**<br>*S. pneumoniae, Hib, E. coli, Salmonellosis, N. meningitidis* | **Birth - 3 months old:**<br>IV Benzylpenicillin<br>**PLUS**<br>IV Cefotaxime<br><br>**More than 3 months old:**<br>IV Benzylpenicillin<br><br>**PLUS**<br>IV Cefotaxime<br>**OR**<br>IV Ceftriaxone | | For children below 3 months of age: Cefotaxime is the preferred third generation cephalosporin since less drug interaction (in terms of interaction with calcium containing infusion and bilirubin displacement)<br><br>Once organism is known, please refer below to adjust antibiotics |
| **Specific organisms** | | | |
| *Haemophilus influenzae* | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone | IV Ampicillin | Duration 10 days |
| *Neisseria meningitidis* | IV Benzylpenicillin | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone | Duration: 7 days<br><br>Prophylaxis for all household contacts and healthcare workers involved in unprotected contact during intubation and suctioning of airway or mouth-to-mouth resuscitation. |
| ***Streptococcus pneumoniae*** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| Penicillin-susceptible (MIC≤0.06mg/L) | IV Benzylpenicillin | | Duration: 14 days |
| Penicillin-resistant (MIC ≥0.12mg/L) & cefotaxime-/ceftriaxone-sensitive (MIC ≤0.5mg/mL) | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone | | |
| Penicillin & cefotaxime-/ceftriaxone -resistant (MIC ≥2.0mcg/ml) (drug-resistant *Streptococcus pneumoniae*, DRSP) | High dose IV Cefotaxime<br>**OR**<br>High dose IV Ceftriaxone<br><br>**PLUS**<br>IV Vancomycin | | Treat in consultation with ID specialist |
| **Cryptococcal meningitis**<br>*Cryptococcus neoformans* | **Induction therapy:**<br>IV Amphotericin B<br>**PLUS/MINUS**<br>Oral 5-flucytosine (5-FU) for 2 to 4 weeks<br><br>**Consolidation Therapy:**<br>IV/PO Fluconazole for 8 weeks | | Duration of induction with 5-FU at least two weeks and until CSF repeat culture is NEGATIVE. |
| ***Herpes Simplex* encephalitis** | **4 months to 12 years old**<br>IV Acyclovir | | Duration: 14 to 21 days (treat in consultation with ID specialist) |
| **Brain abscess** | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone<br><br>**PLUS**<br>IV Metronidazole | If secondary to trauma:<br>**PLUS**<br>IV Cloxacillin<br>(add to 3rd-generation cephalosporin) | Surgical drainage may be indicated if appropriate.<br><br>Duration 6-8 weeks, depending on response as seen from neuroimaging & clinical presentation. |

**References:**


1. Academy of Medicine of Malaysia Clinical Practice Guidelines on Rational Antibiotic Utilisation in Selected Paediatric Conditions April 2004
2. The Sanford Guide to Antimicrobial therapy 2018

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| 3. Malaysia Paediatric Protocol, 4th ed. 2018, Kementerian Kesihatan Malaysia | | | |

## GASTROINTESTINAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Acute gastroenteritis**<br>Usually viruses e.g.:rotavirus | Antibiotics not recommended | | Oral rehydration is the cornerstone of treatment.<br><br>Antibiotic therapy may prolong carriage state of salmonellosis. |
| **Dysentery**<br>*Shigella, E. coli, Campylobacter*<br><br>Mild or uncomplicated<br><br>Severe illness (hospitalisation, invasive or other complications) or immunocompromised patients | Most are mild infections which resolved spontaneously without antibiotics<br><br>No treatment required<br><br>**Empiric:**<br>IV Ceftriaxone for 5 days<br>(origin of infections: Asia) | *PO Ampicillin for 5-7 days for hospitalized children<br><br>IV Azithromycin for 3 days | Resistance patterns towards amoxicillin, trimethoprim sulphamethazole, ciprofloxacin & azithromycin are on the rise. Adjust antibiotic once culture & sensitivity (C&S) results are available.<br><br>For immunocompromised host-treat longer (7-10 days).<br><br>Reserve fluoroquinolone only for isolate where there is no other antibiotic option available due to its many side effects.<br><br>*PO Ampicillin not available in HRPB Formulary. |
| **Dysentery**<br>*Amoebiasis* | PO Metronidazole for 7-10 days | | Similar dosage for extraintestinal disease |
| **Giardiasis** | PO Metronidazole for 5-7 days | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Typhoid fever**<br><br>*Salmonella* Typhi<br>*S.* Paratyphi A&B<br><br>Mild or uncomplicated<br><br>Severe infection or suspected resistant organism<br><br>Chronic carrier state(>1year) | **Empirical treatment:**<br>IV Ceftriaxone for 7-14 days<br><br>PO Ciprofloxacin for 5-7 days<br><br>IV Ceftriaxone for 7-14 days<br><br>*PO Ampicillin for 6 weeks<br>**OR**<br>PO Amoxicillin for 6 weeks<br>**OR**<br>PO Trimethoprim/sulfamethoxazole for 6 weeks | PO Chloramphenicol for minimum 14 days<br><br>PO Ciprofloxacin for 7-10 days<br><br>PO Ciprofloxacin for 4 weeks<br>**OR**<br>IV Ampicillin<br>(If oral therapy not tolerated & strain is susceptible) | Adjust antibiotic once C&S results are known.<br><br>Duration of antibiotics: 7 days (uncomplicated) to 14 days (severe disease or if using ampicillin or trimethoprim/sulfamethoxazole).<br><br>Choice of antibiotics & duration depends on disease, C&S results & whether oral route is preferred.<br><br>Fluoroquinolones need to be used with caution in children due to possible arthropathy & rapid development of resistance. There is now increasing data of other side effects e.g hypoglycaemia & neuropsychiatric disorder.<br><br>Ampicillin & trimethoprim/sulfamethoxazole may be considered for susceptible strain. More strains are now becoming sensitive to these agents except for certain countries.<br><br>*PO Ampicillin not available in HRPB Formulary |
| **Cholera** | PO Azithromycin in a single dose<br>**OR** | | Oral or IV rehydration is the cornerstone of treatment. Prompt |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | PO Erythromycin Ethylsuccinate for 3 days<br>**OR**<br>PO Doxycycline<br>(children>8 years old) single dose | | initiation of antibiotic therapy reduces the volume & duration of diarrhea. Antimicrobials should be considered for people who are moderately to severely ill. Choice dependent on age & pattern of resistance.<br><br>Monitor antimicrobial sensitivity pattern at beginning of & during the outbreak as it can change<br><br>Avoid using tetracycline or doxycycline for young children as they can cause staining of the teeth.<br><br>Use of doxycycline should be considered in an epidemic caused by susceptible isolates.<br><br>Fluoroquinolones are not approved for children younger than 18 years old for this indication. |
| **Liver abscess (amoebic)**<br>*Entamoeba Histolytica* | PO Metronidazole for 7-10 days | | Amoebic abscess tends to be solitary lesion. Consider surgical drainage if needed. |
| **Liver abscess (pyogenic)**<br>*Klebsiella spp., E.coli, Streptococcus milleri,*<br>other Gram-negative | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone<br><br>**PLUS** | IV Piperacillin/tazobactam<br><br>**ESBL-*Klebsiella*:**<br>IV Ertapenem<br>(above 3 months of age) | Surgical drainage is needed in most cases<br><br>Duration: 4-6 weeks |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| organisms, anaerobes, *S. aureus* | IV Metronidazole | | |
| **Acute cholangitis**<br>Gram-positive &<br>Gram-negative organisms, anaerobes | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone<br><br>**PlUS**<br>IV Metronidazole | IV Piperacillin/tazobactam<br>**OR**<br>IV Ampicillin/sulbactam | Duration: 7 days. Outcome is similar with less than 7 days to those with longer duration > 7 days in patients treated with percutaneous cholecystectomy. In treatment failure, source control is needed. |
| **Peritonitis**<br>Gram positive &<br>Gram-negative organism,anaerobes | **Primary/spontaneous bacterial peritonitis**<br>IV Cefotaxime<br><br>**Secondary (nosocomial) peritonitis**<br>IV Piperacillin/tazobactam<br><br>**If culture proven ESBL:**<br>IV Imipenem/cilastatin<br>**OR**<br>IV Meropenem<br>De-escalate treatment to IV ertapenem once patient is stable | *PO Ampicillin<br>**PLUS**<br>IV Gentamicin<br>**PLUS**<br>IV Metronidazole for 7-14 days | May omit metronidazole in primary peritonitis.<br><br>In immunocompetent patients with mild to moderate peritonitis & source control, suggest 5 days of therapy.<br><br>Ertapenem is not licenced to be used in infants less than 3 months old<br><br>*PO Ampicillin not available in HRPB Formulary<br>(Alternative: PO Unasyn) |

**References:**

1. CDC. Antibiotics Resistance Threats in the United States 2013.
2. Dr. Phoebe Williams, Prof James A Berkeley.Dysentery (Shigellosis) Current WHO Guidelines and the WHO Essential Medicine List for Children. November 2016.
3. Frank Shann, Seventeenth edition, 2017.
4. WHO/V&B/03-07 (2003) Background document: the diagnosis, treatment and prevention of typhoid fever.
5. WHO/CDD/SER/91.15 REV.1. Management of Patient with Cholera.
6. Christoph Lübbert, Johannes Wiegand, Thomas Karlas. Viszeralmedizin. 2014 Oct; 30(5): 334–341.
7. Patrick Mosler. Management of Acute Cholangitis. Gasteroenterol Hepato (NY) 2011 Feb; 7(2): 121–123.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |

8. Solomkin JS, Mazuski JE, Bradley JS, et al.; Surgical Infection Society; Infectious Diseases Society of America. 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. Clin Infect Dis. 2010;50(2):135.
9. American Academy of Paediatrics. Commitee on Infectious Diseases. Red Book: Report of the Committee on Infectious Diseases (2018).

## INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Febrile Neutropenia**<br><br>**First line:**<br>Fever >38°C, neutrophil<500mm3<br><br>*Enterobacterales (Klebsiella* sp.*, E. coli etc.*), *Pseudomonas*, aerobic Gram-positive (*Staphylococci, Streptococci*) | IV Piperacillin/tazobactam<br>**PLUS**<br>IV Gentamicin | IV Cefepime | Need to look at local epidemiological data. |
| **Second line:**<br>Persistent fever > 72 hours<br><br>*Enterobacterales* (*Klebsiella* sp, *E. coli etc.*), *Pseudomonas*, aerobic Gram-positive (*Staphylococci, Streptococci*), *Enterococci* or other resistant organisms<br><br>***DO NOT MODIFY INITIAL COVERAGE BASED SOLELY ON PERSISTENCE OF FEVER** | IV Meropenem<br>**PLUS/MINUS**<br>IV Vancomycin | | Escalate to second line if patient unstable to cover resistant Gram-negative, Gram-positive & anaerobes.<br><br>Consider adding vancomycin in suspected catheter-related infections, positive blood culture for Gram-positive cocci, hypotensive patients & patients who are known to be colonised with MRSA.<br><br>In patients responding to initial empiric antibiotic therapy, discontinue double coverage (empirical vancomycin, if initiated) or double gram negative after 24-72 hours if there is no specific microbiologic |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | indication to continue combination therapy. |
| **Third line:**<br>Fever > 4-7 days with no identified source of fever<br><br>*Candida* sp. *Aspergillus* sp., *Fusarium* sp.<br>Viral: Respiratory viruses are the most common, HSV, VZV | IV Imipenem/cilastatin<br>**PLUS**<br><br>IV Amphotericin B<br>**OR**<br>Lipid Formulation of Amphotericin B | IV Imipenem/cilastatin<br>**PLUS**<br>IV Caspofungin | 1/3 of febrile neutropenic patients with persistent fever >1 week have systemic fungal infections[2]<br><br>In patients at high risk of invasive fungal disease with prolonged (≥96 hours) febrile neutropenia unresponsive to broad spectrum antibacterial agents, initiate antifungal.<br><br>Amphotericin-based antifungal is considered broader spectrum than echinocandin (e.g. Caspofungin). |

**References:**


1. ß lactam monotherapy versus ß 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 recepients. Lehrnbecher T, Robinsn P, Fisher B,, Alexander S, Ammann RA, , Beauchemin M, Carlesse F, Groll AH, Haeusler GM, Santolaya M, Steinbach WJ, Castagnola E, Davis BL, Dupuis LL, Gaur AH, Tissing WJE, Zaotis T, Phillips R, Sung L,J Clin Oncol. 2017;35(18):2082-2094.
4. Empiric treatment against invasive fungal diseases in febrile neutropenic patients: a systematic review and network meta-analysis. Ken Chen, Qi Wang, Roy A. Pleasants, Long Ge. Wei Liu, Kanging Peng and Suodi Zhai. BMC Infectious Diseases. 2017; 17;159.
5. A Randomized, Double-Blind, Multicenter Study of Caspofungin versus Liposmal Amphotericin B for Empirical Antifungal Therapy in Pediatric Patients with Persistent Fever and Neutropenia. Maertens JA, Maedro L, Reilly AF, Lehrnbecher T, Groll AH, Jafri HS, Green M, Nania JJ, Kartsonis NA, Chow JW, Arndt CAS, DePauw BE, Walsh T. Pediatr Infect Dis J. 2010; 29:415-420.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| 6. Lehrnbecher et al. Guideline for Management of fever and neutropenia in children with cancer and hemapoietic stem cell transplantation recipients-2017 update. J Clin Oncology 2017 35:18, 2082- 2094. | | | |

## NEONATAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Congenital & Perinatal Infections** | | | |
| **Meningitis**<br>GBS<br>*E. coli*<br>Listeria<br>other Gram-negative bacilli/rod (GNR) | **Empirical therapy:**<br>IV Benzylpenicillin<br>**OR**<br>IV Ampicillin<br><br>**PLUS**<br>IV Cefotaxime | | Once cultures are known, adjust antibiotics accordingly. |
| **Necrotising enterocolitis (NEC)**<br>Klebsiella,<br>*E. coli,*<br>Clostridia,<br>Coagulase-negative Staphylococci,<br>Enterococci,<br>Bacteroides | IV Ampicillin<br>**PLUS**<br>IV Gentamicin<br>**PLUS**<br>IV Metronidazole<br><br>Duration: 10-14 days | | There is insufficient evidence regarding the duration of antibiotic treatment for NEC. This suggested regimen for NEC is empirical. Once culture is known, decisions regarding choice of antibiotics are best guided by culture results.<br><br>Use vancomycin if CoNS/MRSA is suspected (substitute ampicillin with vancomycin). |
| **Early onset sepsis (<48 hrs)**<br>Group B Streptococcus (GBS),<br>Listeria,<br>Streptococcus sp.,<br>*E. coli,*<br>*Haemophilus influenza,*<br>*Klebsiella* sp. etc. | IV Benzylpenicillin<br>**OR**<br>IV Ampicillin<br><br>**PLUS**<br>IV Gentamicin | | If negative blood culture, initial clinical suspicion not strong & reassuring baby's condition with low CRP, consider stopping antibiotics at 48 hours.<br><br>If positive blood culture or strong clinical suspicion of sepsis but negative culture, may give 5-7 days of antibiotics. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Consider antibiotics for more than 5-7 days if baby not fully recovered & based on pathogen identified on blood culture.<br><br>In this empiric therapy, meningitis is not a consideration.<br><br>Once cultures are known; adjust antibiotics accordingly. |
| **Late onset sepsis >48 hours**<br>Methicillin-sensitive/ -resistant *S. aureus* (MSSA/MRSA), Coagulase-negative staphylococci (CONS), Gram-negative rods (depending on local epidemiological data) | **First line:**<br>IV Cloxacillin<br>**PLUS**<br>IV Gentamicin | | For late onset sepsis, the most common organisms are predominantly Gram-positive cocci, namely staphylococci, especially CONS, in premature neonates & also neonates with central catheters.<br><br>Piperacillin/tazobactam is a good second line option in pneumonia & intra- abdominal sepsis (non-CONS sepsis with good coverage against Gram-positive, Gram-negative & anaerobes).<br><br>There is possibility of Gram-negative rods with inducible β-lactamases & ESBL-producing organisms such as *Klebsiella*, *Serratia* & *E. coli* in some NICU in Malaysia hence need to look at local epidemiology before deciding on suitable second line. |
| | **Second line:**<br>IV Piperacillin/tazobactam | | |
| | **Other options:**<br>IV Cefepime<br>**OR**<br>IV Meropenem<br>**OR**<br>IV Imipenem/cilastatin | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Cefepime is the preferred agent when there are Gram-negative bacteria with extended spectrum cephalosporin resistance due to AmpC-β-lactamases (also termed Class C or Group 1).<br><br>Studies comparing imipenem/cilastatin & meropenem for indication other than meningitis found no significant differences in efficacy or safety between the two. However, a recent meta- analysis suggested that meropenem may be better than imipenem/cilastin in efficacy & safety especially due to more cases of seizure with imipenem (WHO Subcommittee Meeting of the Expert Committee on the Selection & Use of Essential Medicine 2008). |
| **Congenital syphilis**<br>*T. pallidum* | IV Benzylpenicillin (Penicillin G)<br><br>Duration : 10 days<br><br>**<u>If diagnosed with congenital syphilis after one month of age</u>:**<br>IV Benzylpenicillin (Penicillin G) for 10-14 days.<br><br>In infants considered less likely to have syphilis & normal CSF examination including | *IM Procaine penicillin 10 days. | Only severe cases are clinically apparent at birth. Refer to algorithm for diagnosing & evaluation. Re-evaluate & possibly re-treat. Please refer Red Book 2018.<br><br>*Procaine penicillin not available in HRPB Formulary |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | normal physical examination & long bone radiograph:<br>Benzathine penicillin IM in a single dose can be given | | |
| **Congenital toxoplasmosis**<br>*T. gondii* | *Pyrimethamine<br>**PLUS**<br>*PO Sulfadoxine<br>**PLUS**<br>PO Folinic Acid for 12 months<br><br>[*PO Pyrimethamine/sulfadoxine (Fansidar®)] | *PO Pyrimethamine<br>**PLUS**<br>*PO Sulfadiazine<br>**PLUS**<br>PO Folinic Acid | Duration: For 12 months<br><br>Drug regimen is not definitively established. Clinical trials are ongoing.<br><br>Prednisolone q12h can be added if CSF protein ≥1g/dL or active severe chorioretinitis. Steroids given till CSF protein <1g/dL or resolution of severe chorioretinitis.<br><br>Fansidar is currently an "orphan" drug that need special procurement measures to buy. Refer to paediatric ID consultant for treatment and availability of drug.<br><br>* Requires special medicine approval. |
| **Herpes simplex**<br>● Localised skin, eye & mouth (SEM)<br>● Central nervous system (CNS) with or without SEM<br>● Disseminated disease involving multiple organs | IV Acyclovir<br><br>Duration:<br>-Skin, eyes, mouth: 14 days<br>-CNS/disseminated: minimum of 21 days<br><br>All infants surviving neonatal HSV infection of any classification should receive oral acyclovir suppression administered 3 times | | Screen for other STDs.<br><br>For CNS disease:<br>Repeat lumbar puncture at end of therapy for HSV PCR. If PCR remains positive, continue IV acyclovir for another one week.<br><br>Recurrence of HSV can occur & may be a lifelong problem. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | daily for 6 months after completion of parenteral therapy. | | |
| **Tetanus neonatorum** | IV Metronidazole | IV Benzylpenicillin | Duration: 10 days |
| **Congenital gonococcal ophthalmitis/conjunctivitis** | Immediate & frequent saline eye irrigation.<br><br>**Non-disseminated disease:**<br>IV Cefotaxime in a single dose<br><br>May need to continue for 48-72 hours until systemic infection has been ruled out.<br><br>**Disseminated disease:**<br>IV Cefotaxime<br><br>For 7 days, with a duration of 10-14 days, if meningitis is documented. | If penicillin-sensitive, may give IV Benzylpenicillin | Evaluate for signs of disseminated infection (e.g. sepsis, arthritis & meningitis).<br><br>Screen mother & baby for chlamydial infection.<br><br>Screen for other STDs.<br><br>Investigate & treat parents. |
| ***Chlamydia trachomatis* conjunctivitis** | PO Erythromycin Ethylsuccinate<br><br>Duration : 14 days<br><br>Local eye toilet until discharge stops. | PO Azithromycin<br><br>Duration: 3 days | Initial treatment for chlamydial conjunctivitis should be based upon a positive diagnostic test.<br><br>Re-swab after treatment; 20-30% will need a second course to clear infection. |
| **GBS** *Streptococcus agalactiae* | | | |
| Sepsis | IV Benzylpenicillin<br>**OR**<br>IV Ampicillin<br><br>**PLUS**<br>IV Gentamicin | | Duration of treatment for GBS:<br>-Uncomplicated: 14 days (bacteremia without a defined focus).<br>-Meningitis: 21 days. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Gentamicin can be discontinued once the infection is under control. |
| Meningitis | IV Benzylpenicillin<br>**OR**<br>IV Ampicillin<br><br>**PLUS**<br>IV Gentamicin | | Duration for treatment: 21 days.<br><br>Doses of penicillin for meningitis is higher as recommended by experts (as high as 500,000 unit/kg/day (> 7 days of age). |
| ***E. coli***<br>Sepsis/Meningitis | IV Cefotaxime<br>**PLUS**<br>IV Gentamicin | | Duration in bacteremia: 14 days.<br>Duration for meningitis: 21 days.<br><br>All cases of bacteremia need lumbar puncture to exclude meningitis.<br><br>Treatment duration of 14 days can be decided on a case-by-case basis if meningitis excluded & good clinical response. |

**References:**


1. Congenital syphilis. 2015 Treatment Guidelines. Available at https://www.cdc.gov/std/tg2015/congenital.htm.
2. Yvonne A. Maldonado, MD, FAAP, Jennifer S. Read. Diagnosis, Treatment, and Prevention of Congenital Toxoplasmosis in the United States. PEDIATRICS. Volume 139, number 2, February 2017:e 20163860.
3. Swetha G. Pinninti, David W. Kimberlin.Neonaal Herpes Simplex Virus Infections. Seminars in Perinatology 42(2018) 168-175.
4. Christina W. Obiero, Anna C. Seale, James E. Berkley. The Pediatric Infectious Disease Journal •Volume 34, Number 6, June 2015.
5. American Academy of Paediatrics. Commitee on Infectious Diseases. Red Book: Report of the Committee on Infectious Diseases (2018).
6. The Sanford Guide to Antimicrobial therapy 2018.
7. IBM Micromedex Neofax version number v50_190403210

## ORAL/DENTAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **ANTIMICROBIAL USE FOR BACTERIAL INFECTIONS** | | | |
| **Dental Trauma** | | | |
| Avulsion of permanent teeth or incisors with an open or closed apex | PO Amoxicillin<br>**OR**<br>PO Phenoxymethylpenicillin (Penicillin V) | **Penicillin Allergy:**<br>PO Doxycycline | The use of systemic antibiotics is recommended after replantation of an avulsed tooth.<br><br>Risk of discoloration of permanent teeth must be considered before systemic use of tetracycline or doxycycline. Tetracycline or doxycycline are generally not recommended for children under 8 years of age.<br><br>Topical antibiotics are not recommended. |
| Luxations orlLuxation injuries in the primary dentition | Systemic antibiotic use not recommended | Systemic antibiotic use not recommended | |
| Dental Fractures | Systemic antibiotic use not recommended | Systemic antibiotic use not recommended | |


References:

1. American Academy of Pediatric Dentistry. Use of anti- biotic therapy for pediatric dental patients. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2021:461-4
2. Fouad AF, Abbott PV, Tsilingaridis G, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol*. 2020;36:331– 342.
3. Day P, Flores MT, O'Connell A, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 3. Injuries in the primary dentition. *Dent Traumatol*. 2020;36:343–359.

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


4. Bourguignon C, Cohenca N, Lauridsen E, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. *Dent Traumatol*. 2020;36:314–330.
5. Goel D, Goel, Gaurav K, et al. Antibitoic prescriptions in pediatric dentistry. *Journal of Family Medicine and Primary Car.* 2020; 9:2:473-480
6. Oral Health Programme Ministry of Health Malaysia. Management of Avulsed Permanent Anterior Teeth. *Clinical Practice Guideline 3rd Edition 2019*
7. American Academy of Pediatrics (AAP). In: Kimberlin DW, Brady MT, Jackson MA, Long SA, eds. *Red Book*: 2015 Report of the Committee on Infectious Diseases. 30th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
8. American Academy of Pediatrics (AAP). In: Kimberlin DW, Brady MT, Jackson MA, Long SA, eds. *Red Book*: 2018 Report of the Committee on Infectious Diseases. 31th ed. Itasca, IL: American Academy of Pediatrics; 2018
9. Lexicomp Online, Pediatric and Neonatal Lexi-Drugs Online. Waltham, MA: UpToDate, Inc.; 8 April, 2022. https://online.lexi.com. Accessed June 1, 2022.

## OTORHINOLARYNGOLOGY INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Tonsillitis/Pharyngitis**<br>Group A *Streptococcus* | PO Phenoxymethylpenicillin (penicillin V)<br>**OR**<br>PO Amoxicillin | PO Cephalexin<br>**OR**<br>PO Erythromycin Ethylsuccinate | Duration: 7 days |
| **Rhinosinusitis**<br>*Streptococcus pneumoniae*<br>*Haemophilus influenzae*<br>*Moraxella catarrhalis*<br>Group A Streptococcus | PO Amoxicillin for 10 days<br><br>**Second line:**<br>PO Amoxicillin/clavulanate<br><br>**Failing amoxicillin/clavulanate:**<br>PO Clindamycin<br>**AND**<br>PO Cefuroxime<br><br>**Inpatient (severe):**<br>IV Ampicillin/sulbactam | **<u>Penicillin Allergy:</u>**<br>PO Clindamycin<br><br>IV Ceftriaxone | The most common causes are viral infections. Acute bacterial sinusitis is suspected when child with URI presents with:<br>1. Persistent illness (nasal discharge or daytime cough or both for ≥10 days without improvement)<br>2. Worsening course<br>3. Severe onset (concurrent fever & purulent discharge for 3 days)<br><br>For rhinosinusitis, most experts recommend using high dose amoxicillin. |
| **Acute otitis media**<br>*Streptococcus pneumonia*<br>*Haemophilus influenzae*<br>*Moraxella catarrhalis* | PO Amoxicillin<br><2 years old : 10 days<br>2-5 years old: 7 days<br>>5 years old : 5 days.<br><br>For clinical failure, history of using amoxicillin in the last 30 days & has concurrent purulent conjunctivitis:<br>PO Amoxicillin/clavulanate | **<u>Penicillin Allergy:</u>**<br>PO Erythromycin Ethylsuccinate<br>**OR**<br>PO Clarithromycin<br>**OR**<br>PO Azithromycin | |
| **Acute otitis externa**<br>*Pseudomonas aeruginosa*<br>*Staphylococcus aureus* | **Mild to moderate:**<br>Topical antibiotic with/without topical steroids. | | Ototoxic agents like gentamicin or neomycin should not be used in the presence of tympanostomy tubes or |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | E.g.<br>Gentamicin 0.3% ear drop for 7 days<br><br>Polymyxin B sulphate, neomycin sulphate & hydrocortisone ear drops for 7 days<br><br>Ofloxacin 0.3% otic solution for 7 days<br>Indication: for 1-12 years old | | perforated tympanic membrane.<br><br>Clinical response should be seen within 48 to 72 hours but full response may take up to 6 days.<br><br>Non-response should prompt an evaluation for obstruction, presence of foreign body, non-adherence or an alternative diagnosis. |

**References:**


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. Charles PS Hui: Canadian Paediatric Society.Paediatr Child Health 2013:18(2):96-98
4. The Sanford Guide to Antimicrobial therapy 2018.
5. American Academy of Paediatrics. Commitee on Infectious Diseases. Red Book: Report of the committee on Infectious Diseases (2018).

## RESPIRATORY INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Community-acquired Pneumonia** | | | |
| **Pneumonia (outpatient) Infant (≥3 months) & children**<br><br>Viral infection is more common<br>(Influenza, RSV, human metapneumovirus (hMPV), Parainfluenza, Adenovirus)<br><br>Bacteria<br>*(S. pneumoniae, Group A Streptococcus,*<br>*S. aureus, H. influenza)* | *High-dose PO Amoxicillin for 5-7 days<br><br>**<u>For influenza:</u>**<br>PO Oseltamivir | PO Erythromycin Ethylsuccinate | Antibiotics are not routinely recommended since viral infection is more common.<br><br>For infants & children admitted to hospital, treat as presumed bacterial unless viral origin is known.<br><br>Macrolide antibiotics should be used if either mycoplasma or chlamydia pneumonia is suspected. It may be started in school-going children where disease predominates.<br><br>Duration: minimum 5 days & until afebrile for 2-3 days in empiric therapy with absence of an identified specific etiology & specific therapy with known pneumonia due to pneumococcus, *HI & Moraxella catarrhalis.*<br><br>*Experts recommend using high dose amoxicillin to overcome resistance conferred by cell wall changes of the bacteria (pneumococcus). If a child cannot tolerate high doses, the |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | standard amoxicillin dose can be used. |
| **Pneumonia (inpatient, fully immunised)** | IV Benzylpenicillin for 5-7 days | **Second line/partially treated**<br>IV Cefuroxime<br>**OR**<br>IV Amoxicillin/clavulanate | Macrolide antibiotics should be used if pneumonia due to *Mycoplasma* or *Chlamydia* is suspected. |
| **Severe Community-acquired Pneumonia** | | | |
| **Child not fully immunised/life-threatening** | IV Cefotaxime<br>**OR**<br>IV Ceftriaxone<br><br>**PLUS/MINUS**<br>IV Azithromycin for 5 days | IV Cefuroxime<br>**PLUS/MINUS**<br>IV Azithromycin for 5 days | For the management of empyema, refer Surgical Infection section. |


**References:**

1. M. Harris, J. Clark, N. Coote et al. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. Thorax, vol. 66, no. 2, pp. ii1– ii23.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
2. Daniele Dona et al. Treatment of Community-Acquired Pneumonia: Are All Countries Treating Children in the Same Way? A Literature Review. International Journal of Pediatrics Volume 2017.
3. The Sanford guide to antimicrobial therapy 2018.
4. American Academy of Paediatrics. Committee on Infectious Diseases. Red Book: Report of the committee on Infectious Diseases (2018).

## SKIN AND SOFT TISSUE INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Abscess**<br>*Staphylococcus aureus* | **Mild:**<br>PO Cloxacillin for 5-7 days<br><br>**Severe:**<br>IV Cloxacillin for 5-7 days<br><br>**CA-MRSA:**<br>PO Clindamycin for 5-7 days<br>**OR**<br>PO Trimethoprim/sulfamethoxazole for 5-7 days | PO Cephalexin for 5-7 days | Incision & drainage (I&D) is the MAINSTAY of therapy. Needle aspiration is inadequate, can sent pus obtained during I&D for C&S.<br><br>Use parenteral route for severe infections.<br><br>Consider CA- MRSA if poorly resolving, based on local epidemiology (still generally uncommon). |
| **Animal bites**<br>*Pasteurella multocida,*<br>*Staphylococcus* spp.,<br>*Streptococcus* spp.,<br>*Capnocytophaga* spp.,<br>anaerobes | PO Amoxicillin/clavulanate for 5-7 days | IV Amoxicillin/clavulanate | Consider rabies prophylaxis according to local epidemiology. |
| **Cellulitis**<br>*Staphylococcus aureus,*<br>*Streptococcus pyogenes* | IV Cloxacillin for 5-7 days | PO Amoxicillin for 7 days<br>**OR**<br>PO Cephalexin for 5-7 days | Administer using parenteral route for extensive lesions.<br><br>Total treatment until 3 days after acute inflammation disappears. |
| **Hansen's Disease (leprosy) in children** | **Paucibacillary:**<br>PO Rifampicin<br>**PLUS**<br>PO Dapsone | | -Duration of treatment: 6 months<br>-Surveillance: 5 years |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | **Multibacillary:**<br>PO Rifampicin<br>**PLUS**<br>PO Dapsone<br>**PLUS**<br>PO Clofazimine | | -Duration of treatment:<br>1 year for BI<4; 2 years for BI≥4<br>(BI: Bacteriological index)<br>-Surveillance: 15 years |
| **Impetigo**<br>*Staphylococcus aureus,*<br>*Streptococcus pyogenes* | **Localised:**<br>Topical 2% fusidic acid for 7 days (outpatient) | | |
| | **Generalised:**<br>PO Cloxacillin | PO Cephalexin | Duration: 5-7 days |
| **Necrotizing fasciitis**<br><br>*Streptococcus* spp.:<br>GroupA *Streptococcus* (GABHS), other *Streptococcus*<br><br>Staphylococcal:<br>*Staphylococcal aureus*<br>(MSSA & CA-MRSA) | **Streptococcal necrotising Fasciitis:**<br>IV Benzylpenicillin<br>**PLUS**<br>IV Clindamycin | | 50% of patients have associated streptococcal toxic shock syndrome (STSS).<br><br>Aggressive surgical debridement of the deep-seated infection is the mainstay of the therapy.<br><br>Combination therapy is needed with clindamycin to block toxin production whether or not patient manifests toxic shock syndrome. Tissues should be sent for Gram staining & C&S.<br><br>IVIG can be used as an adjunct.<br><br>Vancomycin is NOT RECOMMENDED for the treatment of serious MSSA infections because outcomes are INFERIOR compare with cases in which anti-staphylococcus beta-lactam |
| | **Staphylococcal Necrotising Fasciitis:**<br>IV Cloxacillin<br>**PLUS**<br>IV Clindamycin | **If CA-MRSA is suspected:**<br>IV Vancomycin | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | (cloxacillin) is used AND to minimise the emergence of vancomycin resistance<br><br>Duration of treatment: at least 2 weeks if no foci is found (no deep-seated involvement plus no involvement of heart, bone, joint etc.) |
| **Scalded skin syndrome (SSSS)**<br>*Staphylococcus aureus* | IV Cloxacillin<br><br>**<u>Step down</u>**<br>PO Cloxacillin<br><br>Total treatment duration: 7-10 days | | If no positive blood culture associated with SSSS, then intravenous therapy can be stopped following clinical improvement & switch to oral. |

**References:**


1. Guidelines for the diagnosis and management of skin and soft tissue infections: 2014 Update by the Infectious Diseases Society of America (IDSA):Clin Infect Dis 2014;59:e10.
2. Malaysian clinical practice guideline on management of leprosy 2014.
3. The Sanford guide to Antimicrobial therapy 2018.
4. American Academy of Paediatrics Commitee on Infectious Diseases. Red Book: Report of the committee on Infectious Diseases (2018).

## SURGICAL INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **A. General Surgery** | | | |
| **Empyema thoracis (Lung empyema):**<br>*Staphylococcus aureus*<br>*Streptococcus pneumoniae*<br>Empiric treatment is used to cover organisms mentioned above.<br><br>Other bacteria:<br>*Streptococcus pyogenes*, *Haemophilus influenzae*, other Gram-negative organisms in immunocompromised individuals<br><br>In patients not responding to treatment need to rule out TB | IV Cefuroxime<br>**PLUS**<br>IV Cloxacillin | ***S. aureus* (methicillin-sensitive):**<br>IV Cloxacillin<br><br>***S. pneumoniae* (penicillin-sensitive):**<br>IV Benzylpenicillin<br><br>***S. pneumoniae* (penicillin-resistant, use result of C&S):**<br>IV Cefotaxime<br>**OR**<br>IV Ceftriaxone | Based on C&S of pleural fluid/tissue or blood culture.<br><br>All children with empyema need to receive high dose antibiotic therapy via intravenous route to ensure pleural penetration.<br><br>Pneumatocoeles on CXR indicate *S. aureus* BUT they can also be seen in pneumococcal disease.<br><br>There is NO need to routinely use a macrolide antibiotic but its use should be considered in children whom *Mycoplasma pneumoniae* is thought to be the cause (*Mycoplasma* usually causes effusion, not empyema).<br><br>There is **NO CONSENSUS** on how long antibiotics need to be given. Most recommend **4-6 weeks** of total antibiotics.<br><br>For other adjunct therapy, refer MOH consensus guideline 2013. |
| **Enterocolitis** | IV Cefotaxime<br>**PLUS** | IV Ampicillin<br>**PLUS** | Antibiotics should be adjusted with results of C&S. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| *Enterobacteriaceae , Enterococci, Bacteroides* | IV Metronidazole | IV Metronidazole | |
| **B. Bone & Joints Infections** | | | |
| **Septic Arthritis (SA) & Osteomyelitis (OM)**:<br><br><u>0-2 months:</u><br>*Staph. aureus*<br>*Streptococcus agalactiae*<br>Gram-negative enteric organisms<br><br><u>Less than 5 yrs:</u><br>*Staph. aureus*<br>*Streptococcus pyogenes*<br>*Streptococcus pneumoniae*<br>Non-typeable *Haemophilus* spp.<br>*Kingella Kingae*<br><br><u>Older than 5 yrs:</u><br>*Staph. aureus*<br>*Streptococcus pyogens* | **0-2 months:**<br>IV Cloxacillin<br>**PLUS**<br>IV Cefotaxime | Optimize antimicrobial treatment based on C&S | Empiric antibiotics should be started based on clinical diagnosis of SA or OM.<br><br>Surgical debridement is often not required in OM.<br><br>Urgent washout & drainage is needed in SA in hip and other joints to reduce pressure on growth plate.<br><br>*IV antibiotics can be switch to oral if no concurrent bacteremia when:<br>Child afebrile and pain free for at least 24 hrs and CRP <20mg/L or CRP decreased by ≥2/3 of highest value.<br><br>**Duration of antibiotics:**<br>-SA: total of 3-4 weeks<br>-OM: 4-6 weeks<br>-In complex disease (multifocal, significant bone destruction, immunocompromised host and resistant/unusual pathogens), need prolonged intravenous antibiotics and duration might exceed 6 weeks. |
| | **Children less than 5 yrs:**<br>IV Cefuroxime (monotherapy) | IV Cefazolin<br>(can be use in children with suspected *S. aureus* or *S. pyogenes*; less hypersensitivity reaction compared to cloxacillin and dosing convenience)<br><br>**Kingella kingae* - uncommon organism causing infection in <5 yrs old; sensitive to β-*lactam* antibiotics e.g. cefuroxime or amoxicillin/clavulanate | |
| | **Children older than 5 yrs:**<br>IV Cloxacillin | | |

**References:**


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

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


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 | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| Typhoid fever | Refer to Gastrointestinal infections Section | | |
| Cholera | Refer to Gastrointestinal infections Section | | |
| **Scrub Typhus** | | | |
| *Ricketsia tsutsugamushi* | PO Doxycycline for 5-7 days | PO Azithromycin for 3 days | Doxycycline can be used in young children (even below 8 years old) since safety data approved its use for rickettsial diseases. |
| **Brucellosis** | | | |
| *B. melitensis, B. abortus, B. suis and B. canis* | PO Rifampicin for 6 weeks<br><br>**PLUS**<br>**For children**<br>**<8 years old:**<br>PO Trimethoprim/sulfamethoxazole (TMP dose) for 6 weeks<br>**OR**<br>**>8 years old:**<br>PO Doxycycline for 6 weeks<br><br>**Serious illness**<br>**PLUS**<br>IV Gentamicin for 7-14 days | | For non-localized disease:<br>Can use two-drug combination.<br><br>Drug of choice for Brucellosis for children >8 years old:<br>Doxycycline (plus rifampicin) |
| **Leptospirosis** (*L. icterohaemorrhagiae, L. canicola*) | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| Moderate to severe disease | IV Benzylpenicillin | IV Ceftriaxone<br>**OR**<br>IV Cefotaxime | Duration: 7 days |
| Mild disease | PO Amoxicillin | **For children >8 years old:**<br>PO Doxycycline | |
| **Tetanus** (*Clostridium tetani*) | | | |
| | IV Metronidazole for 7-10 days | IV Benzylpenicillin for 7-10 days | Primary tetanus infection:<br>Clinical diagnosis to be made as negative culture is often.<br><br>Steps in care:<br>1. Early airway protection & treatment of reflex spasm with benzodiazepine (midazolam).<br>2. Neutralization of toxin: TIG single dose, administered IM (optimal dose not established).<br>3. Surgical debridement of infected tissues. |
| | **Neutralization of toxin:**<br>Human tetanus globulin (TIG) IM as a single dose | <u>If TIG not available:</u><br>IVIG as a single dose | |
| **Melioidosis** (*Burkholderia pseudomallei*) | | | |
| **Intensive/Induction therapy:** | IV Ceftazidime | IV Imipenem/cilastatin<br>**OR**<br>IV Meropenem | Duration: 2-8 weeks<br>● Uncomplicated : 2 weeks<br>● Complicated pneumonia, deep-seated infection, neurological meliodosis, osteomyelitis & septic arthritis: 4-8 weeks. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Maintenance therapy:** | **Child > 8yrs old:**<br>PO Trimethoprim/sulfamethoxazole (TMP)<br>**PLUS**<br>PO Doxycycline in 2 divided doses | **Child < 8yrs old:**<br>PO Amoxicillin/clavulanate<br>(higher relapse rate) | Duration: 20 weeks<br><br>PO Folic acid to be given for patients on trimethoprim/sulfamethaxazole.<br><br>Consider combination therapy of two drugs in maintenance phase if high risk of relapse. |
| **Malaria** | | | |
| ***Plasmodium falciparum***<br><br>a) Uncomplicated<br>b) Treatment failure<br>c) Complicated<br>(Almost always due to *P. falciparum*, suspect mixed infections if *P. vivax*/P. *knowlesi* malaria appears more severe than usual) | **Uncomplicated**<br>PO Artemether/lumefantrine (Riamet®)<br><br>Duration: 3 days | PO Artesunate/mefloquine FDC (ASMQ)<br>(ASMQ is available as FDC tablet 25/55mg & 100/220mg)<br><br>Duration: 3 days | Artesunate/mefloquine may cause seizure in children with epilepsy.<br><br>Riamet® should be served with high fat diet e.g milk to enhance absorption.<br><br>Primaquine 0.25mg base/kg to be given on Day 1 as a single dose in addition to artemisinin-based combination therapy (ACT) (G6PD testing is not required prior to administration of this dose). |
| | **Treatment failure**<br>An alternative artemisinin-based combination therapy (ACT) regimen to be used.<br>(If Riamet® is used as the first line regimen, use ASMQ & vice versa) | PO Artesunate<br>**PLUS**<br>PO Clindamycin for 7 days<br><br>**OR**<br><br>PO Quinine<br>**PLUS**<br>PO Clindamycin for 7 days | |
| | **Complicated**<br>Day 1:<br>IV Artesunate on admission, then repeat again at 12 & 24 hours. | *IV Quinine<br>**PLUS** | Avoid using ASMQ (Artesunate/mefloquine) if a patient presents initially with impaired consciousness as increased incidence |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Day 2 -7:<br>IV Artesunate or switch to PO ACT<br><br>Duration: 7 days<br><br>[Parenteral artesunate should be given for a minimum of 24 hours (3 doses) or until patient is able to tolerate orally & thereafter to complete treatment with a complete course of oral ACT (3 days of ASMQ or Riamet®)] | PO Doxycycline<br>**OR**<br>PO Clindamycin<br><br>Duration: 7 days | of neuropsychiatric complications associated with mefloquine following cerebral malaria have been reported.<br><br>Do not use IV artesunate as monotherapy. If IV artesunate needs to be continued indefinitely, clindamycin must be added to the regimen to complete 7 days of treatment.<br><br>IM artesunate (same dose as IV) can be used in patients with difficult intravenous access.<br><br>Children with severe malaria should be started on broad-spectrum antibiotic treatment immediately at the same time as antimalarial treatment.<br><br>*Change to PO quinine if able to tolerate orally. Reduce IV quinine dose by one third of total dose if unable to change to PO quinine after 48 hours or in renal failure or liver impairment. |
| ***P. vivax, P. malariae, P. knowlesi***<br>(*P. malariae* & *P. knowlesi* are chloroquine-sensitive)<br>a) New infection | **New infection:**<br>PO chloroquine for 3 days<br>**PLUS**<br>PO Primaquine for 14 days | | Primaquine is ONLY needed for *P. vivax* for a total of 14 days.<br><br>Primaquine (0.5mg/kg) may cause haemolysis in individuals with G6PD |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| b) Chloroquine-resistant (*P. vivax*) or relapse<br>c) Severe & complicated *P. vivax*, *P. knowlesi* or *P. malariae* | **Chloroquine-resistant (P. vivax) or relapse:**<br>(*In Sabah, considered chloroquine-resistant)<br><br>ACT (Riamet or ASMQ)<br>(dosing as per *P. falciparum* treatment)<br>**PLUS**<br>PO Primaquine for 14 days | PO Quinine for 7 days<br>**PLUS**<br>PO Primaquine for 14 days<br><br>Mefloquine single dose combined with primaquine have been found to be effective (except for *P. knowlesi*) | deficiency, hence G6PD testing is required before administration of primaquine above 0.25mg/kg.<br><br>For those found to have mild to moderate G6PD deficiency, an intermittent primaquine regimen of 0.75mg base/kg weekly for 8 weeks can be given under medical supervision.<br><br>In severe G6PD deficiency, primaquine is contraindicated & should not be used.<br><br>*P. knowlesi* (monkey malaria) can cause severe malaria & should be treated as severe malaria secondary to *P. Falciparum*. |
| | **Severe & complicated *P. vivax*, *P. knowlesi* or *P. malariae***<br>Treat as per severe *P. falciparum* malaria | | |
| Mixed Infection | Treat as *P. falciparum* | | |


**References:**

1. Keren Saklsky et al. Treatment of Human Brucelllosis: systematic review and meta-analysis of randomized controlled trials. BMJ online. 2008. doi:10.1136/bmj.39497.500903.25
2. Silpapojakul K. Paediatric scub typhus in Thailand: a study of 73 confirmed cases. Trans R Soc Trop Med & Hygiene 2004;98:354-9
3. Phimda K et al. Doxycycline versus azithromycin for treatment of leptospirosis and scrub typhus. Antimicrob Agents Chemother. 2007;51(9):3259
4. Szue-Chia Lee et al. Comparative effectiveness of Azithromycin for treating scrub typhus. A PRISMA- compliant systematic review and meta-analysis. Medicine. 2017. 96:36(e7992)
5. Fang Y, Huang Z, Tu C, Zhang L, Ye D, Zhu B. Meta-analysis of Drug Treatment for Scrub Tyhphus in Asia. Intern Med. 2012,;51: 233-2320
6. Guidelines for the Diagnosis, Management, Prevention and Control of Leptospirosis in Malaysia, MOH 2011

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


7. Watt G, Padre LP, Tuazon ML, et al. Placebo-controlled trial of intravenous penicillin for severe and late leptospirosis. Lancet 1988; 1:433-5
8. Panaphut T. Ceftriaxone compared with sodium penicillin G for treatment of severe leptospirosis. ClinInfect Dis 2003; 36:1507-13
9. Suputtamongkol Y. An Open, Randomized, Controlled Trial of Penicillin, Doxycycline, and Cefotaxime for Patients with Severe Leptospirosis. Clin Infect Dis 2004; 39:1417-24
10. Currie BJ. Melioidosis: Evolving Concepts in Epidemiology, Pathogenesis, and Treatment. Semin Respir Crit Care Med. 2015;36:111-125
11. McLeod C, Morris PS, Bauert PA, Kilburn CJ, Ward LM, Baird RW, Currie BJ. Clinical Presentation and Medical Management of Melioidosis in children A 24-Years Prospective Study in the Northern Territory of Ausralia and Reivew of the Literature. Clin Inf Dis. 2015; 60(1):21-6
12. 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
13. WHO Guidelines for the treatment of malaria 2015.WHO/HTM/MAL/2015
14. The Sanford guide to antimicrobial therapy 2018.
15. American Academy of Paediatrics. Committee on Infectious Diseases. Red Book: Report of the Committee on Infectious Diseases (2018).

# TUBERCULOSIS IN CHILDREN

## 1. Anti Tuberculosis Drugs

**Table 1: Recommended doses of anti-TB drugs in children**

| Drug | Recommended Daily Dose | |
|---|---|---|
| | Dose (range) in mg/kg | Maximum dose in mg |
| **Isoniazid(H)** | 10 (7- 15)[a] | 300 |
| **Rifampicin(R)** | 15(10- 20) | 600 |
| **Pyrazinamide(Z)** | 35(30- 40) | 2000 |
| **Ethambutol(E)** | 20(15- 25) | 1000 |

[a] The higher end of the range for INH dose applies to younger children. As the children grow older the lower end of the dosing range becomes more appropriate.

Source: World Health Organization. Guidance for National Tuberculosis Programmes on The Management of Tuberculosis in Children (2nd Edition). Geneva: WHO;2014

Pyridoxine 5 - 10 mg daily needs to be added if isoniazid is prescribed.

Medication dose requires recalculation **every two to four weeks** as children gain weight rapidly, particularly in neonates and young children.

## 2. Treatment Regimen

- Treatment has 2 phases: an initial intensive phase and a second continuation phase.
- Daily directly-observed therapy (DOT) is recommended for treatment of active disease.
- Use of steroids:
  Corticosteroids should be used in tuberculous meningitis and pericarditis (pericardial effusion).

## 3. Latent Tuberculosis Infection Treatment (LTBI)

*Active TB needs to be ruled out before starting LTBI treatment.

- Current regimens used to treat LTBI in children include:
  a. RIF daily for four months (4R)
  b. INH and rifapentine weekly for three months (12 doses) (3HP)
  c. INH and RIF daily for three months (3HR)
  d. INH daily for six or nine months (6H/9H)

- In the treatment of children with latent tuberculosis infection (LTBI), the preferred regimens are: 4R for all children >28 days of age or 3HP* for children aged >2 years. 6H for all newborns aged 28 days and below.

- Alternative regimens of LTBI in children are 3HR, 6H or 9H.

**Table 2: Recommended dosage for LTBI treatment in children**

| Drug | Duration | Interval | Dosage |
|---|---|---|---|
| Isoniazid | 6 months | Daily | 1. Age 10 years and older: 5mg/kg/day<br>2. Age < 10 years: 10mg/kg/day (Range: 7 – 15mg/kg)<br>**Max dose: 300mg** |
| Rifampicin (4R) | 4 months | Daily | 1. Age 10 years and older: 10mg/kg/day<br>2. Age < 10 years: 15mg/kg/day (Range: 10-20 mg/kg) |

| | | | | |
|---|---|---|---|---|
| | | | **Max dose: 600mg** | |
| Isoniazid + Rifampicin (3HR) | 3 months | Daily | Dose of INH and RIF same as above | |
| Rifapentine + Isoniazid (3HP) | 3 months* | Weekly | Isoniazid:<br>10-15 kg : 300 mg<br>16-23 kg : 500 mg<br>24-30 kg : 600 mg<br>>31 kg : 700 mg<br>**(For children age 2-14 years old)** | Rifapentine:<br>10-15 kg : 300 mg<br>16-23 kg : 450 mg<br>24-30 kg : 600 mg<br>>31 kg : 750 mg<br>**(For children age 2-14 years old)** |

*Given in total of 12 doses

Pyridoxine 5 - 10 mg/day should be given to patients on Isoniazid.

Source: World Health Organization. WHO Consolidated Guidelines on Tuberculosis: Tuberculosis Preventive Treatment: Module 1: Prevention. Geneva: World Health Organization; 2020

**References:**

1.Clinical Practice Guideline Management of Tuberculosis. 4 th edition. 2021.
2.World Health Organization. Guidance for National Tuberculosis Programmes on The Management of Tuberculosis in Children (2nd Edition). Geneva: WHO;2014
3.World Health Organization. WHO Consolidated Guidelines on Tuberculosis: Tuberculosis Preventive Treatment: Module 1: Prevention. Geneva: World Health Organization; 2020.

## URINARY TRACT INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Urinary Tract Infection:**<br>*Escherichia coli*<br>*Proteus* spp<br>*Klebsiella* spp.<br>*Enterobacter* spp. | **0-2 months old:**<br>IV Ampicillin<br>**PLUS**<br>IV Gentamicin<br><br>**> 2 months old:**<br>IV Cefuroxime<br>**PLUS/MINUS**<br>IV Gentamicin | **Ill Young Infant:**<br>IV Cefotaxime | Adjust therapy base on culture results<br><br>Duration: 7-14 days<br><br>Switch to oral therapy when improving and being able to tolerate oral therapy. |
| **Prophylaxis for UTI for infants & children with recurrent UTI** | PO Trimethoprim at night | PO Nitrofurantoin at night<br>**OR**<br>PO Cephalexin at night | Antibiotic prophylaxis should not be routinely recommended in children with first-time UTI.<br><br>Avoid nitrofurantoin for infants less than 3 months old, G6PD deficiency, and estimated glomerular filtration rate < 50 ml/min/1.73m2.<br><br>Prophylactic antibiotics should be given for 3 days with MCUG (micturating cystourethrogram) taking place on the second day.<br><br>Children with Grade 4-5 vesicoureteral reflux (VUR) require prophylaxis antibiotic whereas Grade 3 VUR may require prophylaxis antibiotic if associated with many genitourinary tract anomaly with high risk of reflux |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | nephropathy or frequent symptomatic UTI. |

**References:**


1. NICE Guidelines: Urinary tract infection: diagnosis, treatment and long term management of urinary tract infection in children 2007. Last update 2017
2. UTI Clinical Practise Guideline, Pediarics 2011
3. American Academy of Paediatrics. Commitee on Infectious Diseases. Red Book: Report of the Committee on Infectious Diseases (2018).
4. The Sanford Guide to Antimicrobial Therapy 2018
5. BNF Children 2022

## VASCULAR INFECTIONS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Catheter-related BloodStream Infection (CRBSI)** | | | |
| ***Coagulase-negative staphylococcus (CoNS)** | | | |
| Methicillin-sensitive (MSCoNS) | IV Cloxacillin | IV Cefazolin | Diagnosis needs:<br>1. Paired blood cultures drawn from both catheters & peripheral veins.<br>2. If blood cultures cannot be drawn from peripheral veins, it is recommended that two or more blood cultures should be drawn through different catheter lumen.<br><br>Long term catheters should be removed in patients with CRBSI with: Severe sepsis, suppurative thrombophlebitis, endocarditis, blood stream infections that continues despite 72 hours of antimicrobial therapy or longer to which the infecting organism is susceptible or infection due to *Staphylococcus aureus, Pseudomonas aeruginosa,* fungi & *Mycobacterium*.<br><br>Attempts at catheter salvage are only recommended in uncomplicated CRBSI or CLABSI caused by bacteria that are neither too virulent nor too difficult to eradicate. |
| Methicillin-resistant (MRCoNS) | IV Vancomycin | | |
| **Coagulase-positive staphylococcus** | | | |
| Methicillin-sensitive (MSSA) | IV Cloxacillin | IV Cefazolin | |
| Methicillin-resistant (MRSA) | IV Vancomycin | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | Exact optimal duration of therapy has not been established in children with or without catheter removal. 10-14 days after the first negative blood culture is usually recommended.<br><br>*For CONS, we need to decide whether isolates from blood culture are colonisers or true pathogens. |
| **Gram-negative bacilli Enterobacterales** (*Escherichia coli, Klebsiella pneumonia, Enterobacter, Proteus* sp *etc*.) | | | |
| **ESBL negative** | *IV Piperacillin/tazobactam | | *Empiric treatment with piperacillin/tazobactam covers most of the Gram-negative organisms (Enterobacterales), Gram-positive organisms & *Pseudomonas*; follow through with C&S. |
| **ESBL positive** | IV Ertapenem | IV Imipenem<br>**OR**<br>IV Meropenem | |
| ***Pseudomonas aeruginosa*** | IV Piperacillin/tazobactam | IV Cefepime | Not all *Pseudomonas* is drug resistant. If ceftazidime remains susceptible. Please use it with antipseudomonal aminoglycoside to treat. De-escalation is important to preserve antibiotics for future use. |
| ***Candida albicans* or other *Candida* species** | | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | IV Fluconazole | IV Caspofungin<br>**OR**<br>IV Amphotericin B lipid complex | Fungaemia: treatment without catheter removal is associated with low success rate & higher mortality. |
| **Suppurative Thrombophlebitis** (*Staphylococcus aureus*) | | | |
| MSSA | IV Cloxacillin | IV Cefazolin | Diagnosis requires positive blood culture plus radiographic demonstration of thrombus.<br><br>Remove catheter & a minimum antibiotic treatment of 3-4 weeks. Surgical resection of involved vein if failed conservative therapy. |
| MRSA | IV Vancomycin | | |


**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.
4. Janum S et al.Bench to bedside review: Challenges in diagnosis, care and prevention of central catheter related bloodstream infections in children. Critical Care 2013.17:238.
5. The Sanford guide to antimicrobial therapy 2018.

# CHEMOPROPHYLAXIS

## A. SURGICAL CHEMOPROPHYLAXIS

Guidelines for prevention of surgical site infections (SSIs) have been published. General principles:

1. Agent used for antimicrobial prophylaxis should prevent SSIs and related morbidity and mortality
2. Reduce duration and cost of care
3. Produce no adverse effect
4. Minimise adverse consequences to the microbial flora

**Timing:**
Effective chemoprophylaxis occurs only when the appropriate antimicrobial drug is present in tissues at sufficient local concentration at the time of intra-operative bacterial contamination. Administration of antimicrobial agents is recommended within 60 minutes before surgical incision to ensure adequate tissue concentration at the start of the procedure. Agents that require longer administration time such as vancomycin should begin within 120 minutes before surgery begins. Adequate antimicrobial concentration should be maintained throughout the surgical procedure and in most instances, single dose of antimicrobial agent is sufficient and the duration of prophylaxis after any procedure should not exceed 24 hours. Intraoperative dosing is required if the duration of the procedure is greater than two times the half-life of the antimicrobial agent or if there is excessive blood loss.

| **Infection/ Condition & Likely Organism** | **Suggested Treatment** | | **Remarks** |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Cardiac surgery** | | | |
| *S. epidermidis, S. aureus, Corynebacterium sp., Enteric Gram-negative bacilli* | IV Cefazolin | If known to have MRSA/MRSE colinisation, use IV Vancomycin | **β-lactam Allergy:**<br>IV Clindamycin |
| **Thoracic surgery** | | | |
| Non-cardiac including lobectomy, pneumonectomy, lung resection & thoracotomy | IV Cefuroxime | IV Ampicillin/sulbactam | **β-lactam Allergy:**<br>IV Clindamycin |
| **Abdominal surgery** | | | |
| **Gastroduodenal** | IV Cefotaxime<br>**PLUS/MINUS**<br>IV Metronidazole | IV Ampicillin/sulbactam | **β-lactam Allergy:**<br>IV Clindamycin<br>**PLUS**<br>IV Gentamicin |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| **Biliary tract**<br>Kasai procedure/Choledochal cyst excision | IV Cefotaxime<br>**PLUS**<br>IV Metronidazole | IV Ceftriaxone<br>**PLUS**<br>IV Metronidazole | **β-lactam Allergy:**<br>IV Clindamycin<br>**PLUS**<br>IV Gentamicin |
| **Inguinal surgery**<br>Orchidopexy (Open procedure/Laparoscopic procedure)/Hernia repair (Herniotomy) | No antibiotic routinely | No antibiotic routinely | |
| **Head & neck** | | | |
| **Clean**<br>(tonsillectomy, adenoidectomy, tracheostomy, lymph node biopsy) | No antibiotic routinely | No antibiotic routinely | |
| **Clean**<br>(preauricular sinus, dermoid cyst, branchial anomaly, thyroidectomy, thyroglossal cyst excision, parotidectomy) | IV Augmentin | IV Cefuroxime<br>**OR**<br>IV Ceftriaxone | **β-lactam Allergy:**<br>IV Clindamycin |
| **Clean with placement of prosthesis**<br>(excludes tympanostomy tubes) | IV Cefazolin | IV Ampicillin/sulbactam<br>**OR**<br>IV Cefuroxime | **β-lactam Allergy:**<br>IV Clindamycin |
| **Clean-contaminated procedures with the exception of tonsillectomy & functional endoscopic sinus procedure** | IV Cefazolin<br>**PLUS**<br>IV Metronidazole | IV Ampicillin/sulbactam<br>**OR**<br><br>IV Cefuroxime<br>**PLUS**<br>IV Metronidazole | **β-lactam Allergy:**<br>IV Clindamycin |
| **Clean-contaminated cancer surgery** | IV Cefotaxime<br>**PLUS**<br>IV Metronidazole | IV Ampicillin/sulbactam<br>**OR** | **β-lactam Allergy:**<br>IV Clindamycin |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | IV Cefuroxime<br>**PLUS**<br>IV Metronidazole | |
| **Neurosurgery** | | | |
| **Elective craniotomy & cerebrospinal fluid shunting procedures**<br><br>Types of surgery:<br>Craniotomy/crani-facial<br>Transsphenoidal surgery<br>Spine surgery<br>(Intradural/Extradural lesion)<br>Shunt surgery &<br>Neuroendoscopy<br>Neuroendovascular procedure | IV Cefazolin | If known to have MRSA/MRSE colinisation, use IV Vancomycin | **β-lactam Allergy:**<br>IV Clindamycin |
| **Orthopaedics** | | | |
| Clean operations involving hand, knee or foot & not involving implantation of foreign materials | None | None | |
| Spinal procedure with or without instrumentation/hip surgery/implantation of internal fixation devices (e.g. nails, screws, plates, wires) | IV Cefazolin | | **β-lactam Allergy:**<br>IV Clindamycin |
| **Urology** | | | |
| Low tract instrumentation with risk factors for infections | IV Cefuroxime | IV Cefazolin | **β-lactam Allergy:**<br>IV Gentamicin |
| Clean without entry into urinary tract/clean with entry into | IV Cefuroxime | IV Amoxicillin/clavulanate | UTI should be treated before procedure when possible. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| urinary tract (e.g. hypospadia surgery) | | | Medical literature does not support continuing antimicrobial prophylaxis until the urinary catheter has been removed. |
| Clean-contaminated (entering gastrointestinal tract) | IV Cefotaxime<br>**PLUS**<br>IV Metronidazole | IV Amoxicillin/clavulanate | **β-lactam Allergy:**<br>IV Gentamicin |
| **Plastic surgery** | | | |
| Elective soft tissue surgery | No prophylaxis unless complex prolonged procedure<br>If complex, IV Cloxacillin | | |
| Elective hand & foot surgery involving bone | IV Cloxacillin | | **β-lactam Allergy:**<br>IV Clindamycin |
| Cleft lip & palate surgery | IV Amoxicillin/clavulanate | | **β-lactam Allergy:**<br>IV Clindamycin |
| Excision & grafting surgery | IV Amoxicillin/clavulanate | | **β-lactam Allergy:**<br>IV Clindamycin |
| **Interventional radiology** | | | |
| Percutaneous endoscopic gastrostomy (PEG) or jejunostomy (PEJ) or nephrostomy tube placement | IV Cefazolin | IV Amoxicillin/clavunalate | |
| Micturating cystourethrogram (MCUG) | PO Trimethoprim<br><br>(If patient is already on existing antibiotic UTI prophylaxis, increase antibiotic to therapeutic dose for a single dose prior procedure) | | |
| Tenckhoff peritoneal dialysis catheter insertion | IV Cefuroxime | IV Amoxicillin/clavulanate | |
| Burns | No prophylaxis required | | |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |

**References:**


1. Clinical Practical Guideline for Antimicrobial Prophylaxis for Surgery 2013. American Society of Hospital Pharmacists (ASHP) guideline, IDSA, Surgical Infection Society (SIS) and Society of Healthcare Epidemiology of America (SHEA). Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, Fish DN, Napolitano LM, Sawyer RG, Slain D, Steinberg JP, Weinstein RA. American Journal of Health-system Pharmacy 2013. 70(3):195-283.
2. Antibiotic Prophylaxis for Paediatric Surgery. Royal Hospital for Children Glasgow. 2018.

## B. NON-SURGICAL CHEMOPROPHYLAXIS

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| **Rheumatic fever**<br>(Secondary prevention) | IM Benzathine Penicillin<br><br><u>Duration</u><br>1. **With carditis & residual heart disease (persistent valvular disease)**: 10 years since last ARF or until 40 years of age. Whichever is longer. Consider lifelong prophylaxis<br>2. **With carditis but no residual heart disease (no valvular disease)**: 10 years since last ARF or 21 years of age, whichever is longer<br>3. **Without carditis**: 5 years since last ARF or until 21 years of age, whichever is longer | PO Phenoxymethylpenicillin (Penicillin V)<br><br>**<u>Penicillin Allergy</u>:**<br>PO Erythromycin Ethylsuccinate | |
| **Infective Endocarditis (IE)** | PO Amoxycillin 30-60 minutes before procedure<br>**OR**<br>IV Ampicillin 30 -60 minutes before procedure | **<u>Penicillin Allergy</u>**:<br>IV/PO Clindamycin 30-60 minutes before procedure<br><br>Other alternative:<br>IV Cefazolin (Cephalosporin should not be used in children with anaphylaxis, angioedema or urticaria) | 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.<br><br>Prophylaxis always required for:<br>● Dental procedures that involve extraction, peridontal procedure including surgery, subgingival scaling, root planning, re-planting of avulsed teeth and other surgcal procedure. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | ● Incision and drainage of local abscess in brain, skin, subcutaneous tissue, epidural, lung orbital area, per rectal area, liver, tooth and surgical procedure through infected skin.<br>● Percutaneous endoscopic gastrotomy.<br><br>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. |
| **Post-splenectomy**<br>At risk for *Pneumococcus, Meningococcus, Haemophilus* | PO Penicillin V<br><br>Duration:<br>Minimum 3 years post-splenectomy or until 18 years of age (some expert)<br>**OR**<br>At least 1 year post splenectomy<br><br>Asplenia attributed to other causes unknown - most experts recommend throughout childhood and adulthood. | PO Amoxicillin<br><br>**Penicillin Allergy**:<br>PO Erythromycin Ethylsuccinate | Risk of sepsis is lifelong but especially high in the first two years of splenectomy.<br><br>Important adjunct:<br>Immunization against *Pneumococcus Haemophilus*, *Meningococcus* at least 14 days prior to splenectomy (if not possible then as soon as possible, 14 days or more after surgery)<br><br>Yearly influenza vaccine is also recommended.<br><br>Not all pneumococcal isolates are sensitive to these antibiotics. Limitation stressed to parents so that all febrile illness in this group of |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | children are taken seriously since initial signs & symptoms of fulminant septicemia can be subtle. |
| ***Haemophilus influenza* b exposure** | PO Rifampicin for 4 days | | Chemoprophylaxis indicated for:<br><br>1. <u>All household</u> contacts in the following circumstances (Household contact is defined as a person who resides with the index patient or who spent ≥4 hours with index patient for at least five of seven days before the day of hospital admission of index case):<br>a) Household with at least one contact <4 years old who is unimmunised or incompletely immunised.<br>b) Household with contact who is an immunocompromised child, regardless of the child's Hib immunisation status.<br>c) Household with a child younger than 12 months who has not complete the primary Hib series.<br>2. <u>Nursery Contact:</u> For ALL attendees in childcare & preschool (regardless of age or vaccine status) when unimmunized or incompletely immunized children attend the facility and two or more cases of Hib invasive |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | disease have occurred among attendees within 60 days.<br><br>3. Index case: Prior to discharge if did not receive at least ONE dose of cefotaxime/ceftriaxone & infants younger than 2 years old. For contacts < 2 years old who are not immunised, recommended to complete immunisation. |
| **Meningococcal exposure** | PO Rifampicin for 2 days | IM Ceftriaxone stat | Chemoprophylaxis is provided to close contact at **HIGH RISK** which include:<br>- All household especially children younger than 2 years old<br>- Childcare or preschool contact at anytime during 7days before onset of illness.<br>- Direct exposure to index patient's secretion through kissing or through sharing toothbrushes or eating utensils at any time during 7 days before onset of illness.<br>- Frequently slept in the same place as the index during 7 days before onset of illness.<br><br>Healthcare staff<br>Routine prophylaxis is not recommended unless there is intimate exposure to respiratory secretion, mouth to mouth resuscitation. Unprotected contact |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | during intubation at any time 7 days before onset of illness or within 24hours of initiation of effective antimicrobial therapy.<br><br>Give chemoprophylaxis to index case prior to discharge if treated with regimes other than Ceftriaxone or Cefotaxime. Chemoprophylaxis is ideally initiated within 24hours after index patient is identified; prophylaxis is not indicated more than 2 week after exposure. |
| **Neonatal Group B *Streptococcus* Infection** | Intrapartum maternal prophylaxis till delivery:<br>IV Benzylpenicillin | IV Ampicillin<br><br>**Penicillin allergy**:<br>IV Clindamycin (according to susceptibility) | Treat during labour if previously delivered infants with invasive GBS, GBS bacteriuria or antenatally screening swab positive OR if GBS status is not known AND any of the following:<br>- Preterm <37 weeks<br>- PPROM > 18 hours<br>- Intrapartum temperature > 38°C |
| **Malaria prophylaxis** | PO Chloroquine weekly (begin 1-2 weeks before travelling and take weekly throughout & 4 weeks after leaving the area) | For prophylaxis (chloroquine-resistant):<br><br>*Atovaquone-proguanil<br>**OR**<br>**PO Mefloquine (Start 2-3 weeks before, continue weekly during exposure and 4 weeks thereafter)<br>**OR**<br>Age > 8 years old: | *Atovaquone/proguanil is another drug used in malaria prophylaxis in children (chloroquine resistance) BUT not yet registered in Blue book (available commercially in Malaysia).<br><br>**Mefloquine: Not available in HRPB Formulary |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | PO Doxycycline daily 1-2 days before, during & 4 weeks after travelling. | **Mefloquine: Not recommended if there are cardiac conduction abnormalities, seizures or psychiatric disorders eg: depression, psychosis (Black box warning: Neuropsychiatric reaction may persist even after discontinuation).<br><br>To carefully assess risk and benefit of starting antimalarial prophylaxis to any children to prevent development of drug resistance. |
| **Pertussis**<br>(Post-Exposure prophylaxis, PEP) | **<u>Less than 1 month - 5 monts old:</u>**<br>Azithromycin for 5 days<br><br>**<u>6 months or older:</u>**<br>Erythromycin Ethylsuccinate for 14 days<br>**OR**<br>Azithromycin 5 days | Erythromycin is not preferred in young infants.<br>*Use only if azithromycin is not available.<br><br>**<u>2 months and older:</u>**<br>Trimethoprim/sulphamethoxazole for 14 days | Drug of choice for PEP & treatment is macrolide. Azithromycin is the preferred macrolide. *Association between orally administered azithromycin & erythromycin with infantile hypertrophic pyloric stenosis (especially in infant < 6 weeks) has been reported but azithromycin remains the drug of choice in very young infants because risk of developing severe disease outweighs the potential risk.<br><br>Antimicrobial prophylaxis is recommended for:<br>ALL household contacts of the index cases & other close contacts including children in childcare regardless of immunization status. |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |
| | | | When considering borderline degree of exposure for non household contact, PEP administered if contact is personally at high risk** or lives in a household with high risk of severe disease (e.g. young infant, pregnant women person who has contact with infant).<br><br>Close contact who are unimmunized or underimmunized should have pertussis immunization initiated or continue with age appropriate products according to the recommended schedule as soon as possible. (includes Tdap in children 7-9 years old who did not complete DTaP series).<br><br>**High risk: infant, women at 3rd trimester of pregnancy & people with pre-existing health conditions. (not limited to immunocompromised and those with moderate to severe asthma) |
| **Chicken pox**<br>(Post-exposure prophylaxis)<br>Potential interventions for people without immunity exposed to varicella following significant exposure*<br>1. **Vaccine** | **Varicella vaccine:** | | *Exposure is significant if:<br>1. Household: Residing in same household<br>2. Playmate: Face to face indoor play >1 hour<br>3. Hospital: In same 2 to 4 bedroom or adjacent beds in a large |

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | **Preferred** | **Alternative** | |
| | Within 3-5 days of exposure for the susceptible healthy adult/child 12 months or older (followed by second dose at age-appropriate interval) | | ward, face to face contact with an infectious staff member or patient or visit by a person who is contagious.<br>4. Newborn infants |
| **2. When indicated & available, Varicella zoster immune globulin (VZIG)** | For patient who are at high risk for severe infection & complication* & significant exposure (and have contraindication to vaccine):<br>VZIG as soon as possible after exposure up to 10 days after | Patients receiving monthly high dose IVIG (≥ 400mg/kg) are likely to be protected & probably do not require VZIG if the most recent dose IVIG was administered ≤ 3 weeks before exposure. | *Susceptible host include:<br>1. Immunocompromised children<br>2. Pregnant women, newborn of mothers with varicella shortly before or after delivery. (5 days before or within 2 days after delivery)<br>3. Premature born infants born ≥28 weeks of gestation who are exposed during hospitalization & whose mother does not have any evidence of immunity<br>4. Premature born infants born <28 weeks of gestation or birth weight ≤ 1000g regardless of mothers' immunity. |
| 3. **When VZIG not available** | For patient who are at high risk for severe infection & complication* & significant exposure (and have contraindication to vaccine):<br>IVIG stat<br>**OR**<br>PO Acyclovir beginning 7 to 10 days after exposure & continued for 7 days | | |

**References:**


1. Davies JM, Lewis MP, and Wimperis J et al. Review of guidelines for the prevention and treatment of infection in patient 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 Haematol. 2011; 155:308-17.
2. Rubin LG, Schaffner W. Care of the Asplenic Patient. N Engl J Med 2014; 317:349-56
3. Gardner P. Clinical practice. Prevention of meningococcal disease. N Engl J Med 2006;355:1466
4. Guidance for the public health management of meningococcal disease in UK. Updated February 2018. Public Health England.
5. Verani JR, McGee L, Schrag SJ, Division of Bacterial Disease, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC). Prevention of perinatal group B streptococcus disease-- revised guidelines fromCDC, 2010. MMWR Recomm Resp 2010; 59:1
6. Updated recommendation for use of VariZIG-- United States, 2013. Centres for Disease Control and Prevention (CDC). MMWR Mortal Wkly Rep. 2013;62(28):574

| Infection/ Condition & Likely Organism | Suggested Treatment | | Remarks |
|---|---|---|---|
| | Preferred | Alternative | |


7. WHO Malaria Treatment Guideline 2015
8. The Sanford Guide to Antimicrobial therapy 2018
9. American Academy of Paediatrics. Committee on Infectious Diseases. Red Book: Report on the committee on Infectious Disease (2018).

# (APPENDICES)

## APPENDIX 1: ANTIBIOTIC RESISTANCE DATA (2019 TO 2021)

### A. Common organisms isolated

### 1. By isolates

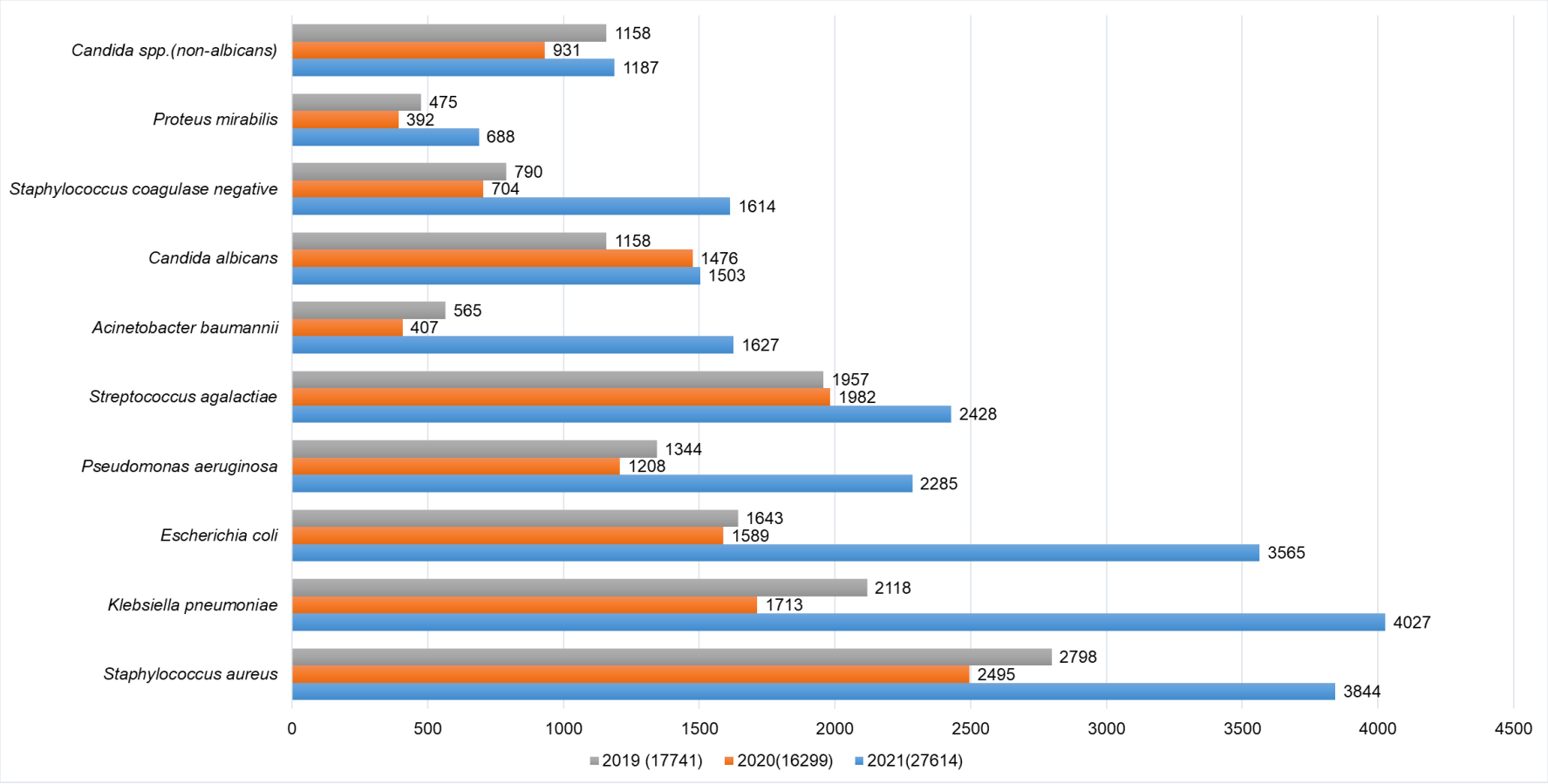



**Figure 1: Common organisms isolated from all samples by isolates**

## 2. By patients

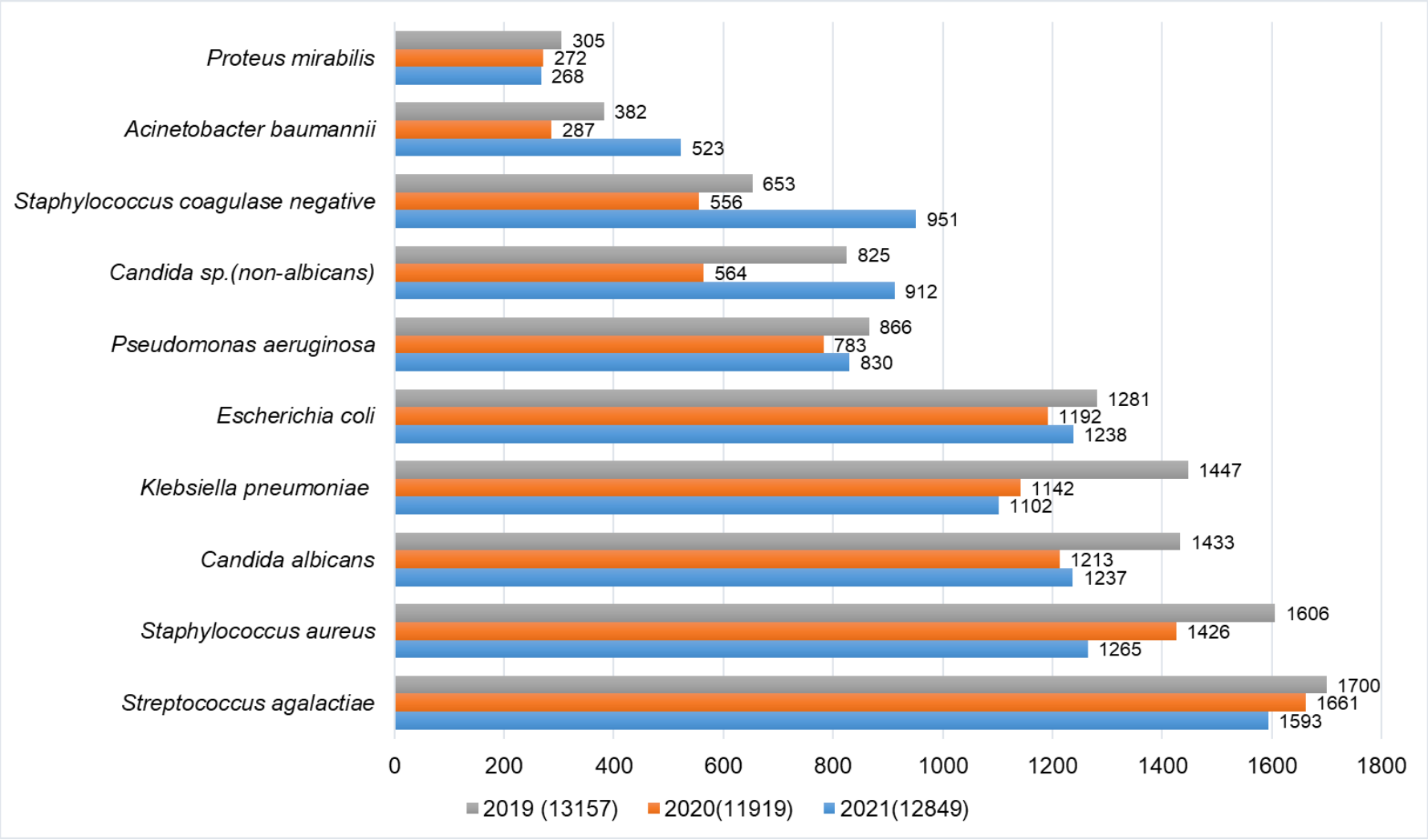


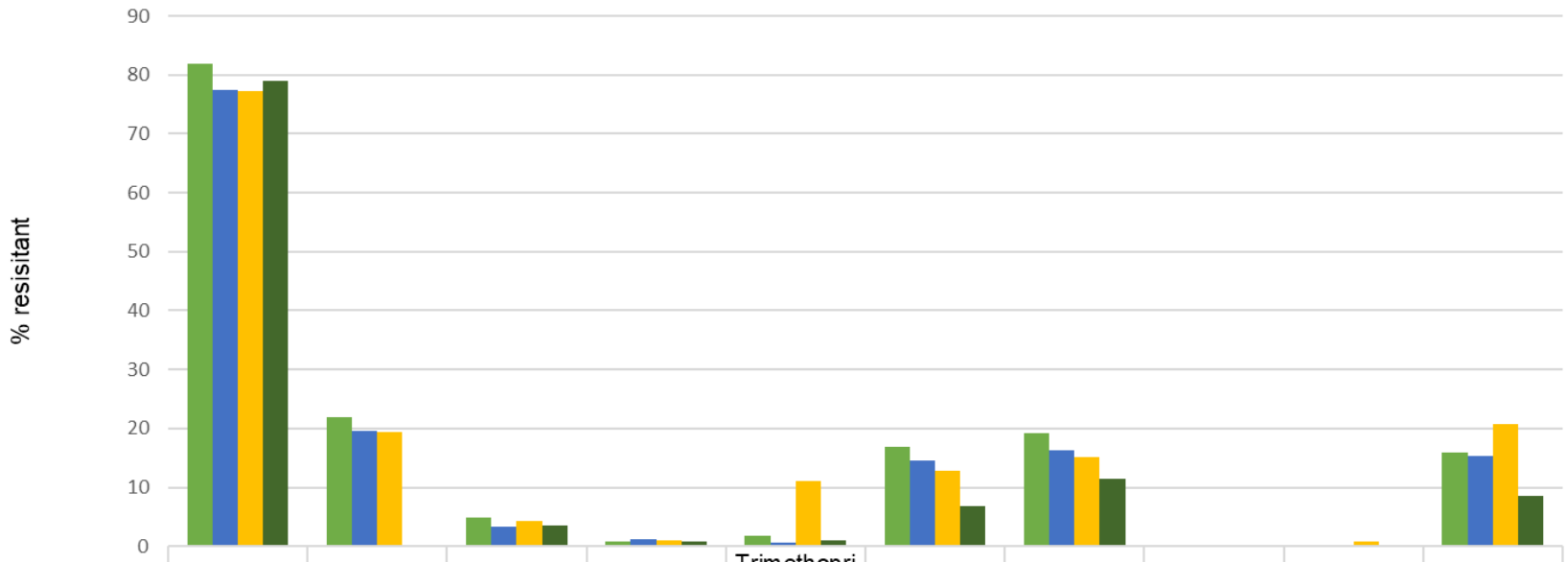

**Figure 2: Common organisms isolated from all samples by patients**

## B. Percentage of antibiotic resistance among bacteria

### *Gram-positive bacteria*

### 1. *Staphylococcus aureus*

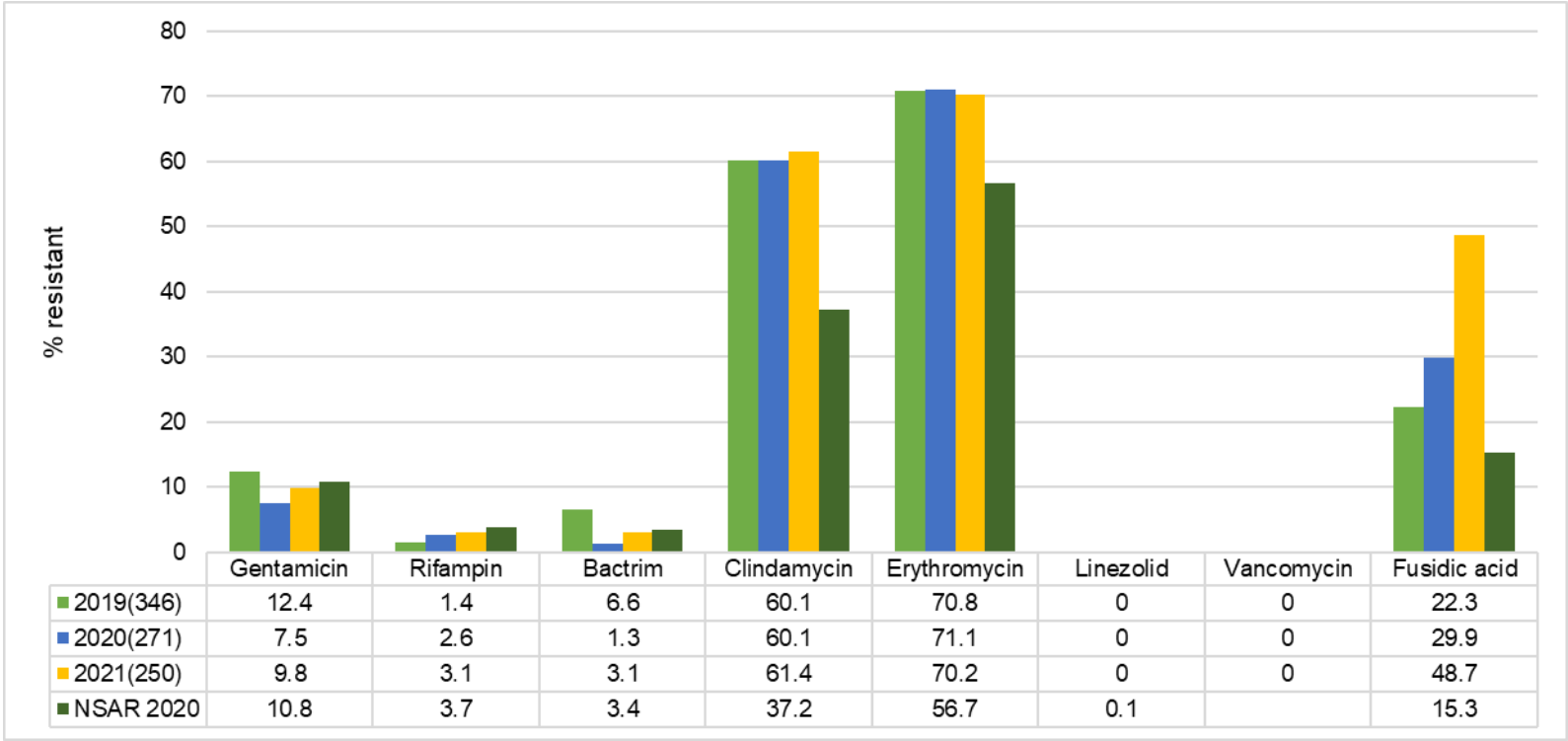
**MSSA**




| | Penicillin G | Oxacillin | Gentamicin | Rifampin | Trimethoprim/Sulfamethoxazole | Clindamycin | Erythromycin | Linezolid | Vancomycin | Fusidic acid |
|---|---|---|---|---|---|---|---|---|---|---|
| 2019(1606) | 81.9 | 22 | 4.8 | 0.8 | 1.8 | 16.8 | 19.2 | 0 | 0 | 16 |
| 2020(1322) | 77.5 | 19.6 | 3.4 | 1.2 | 0.6 | 14.5 | 16.2 | 0 | 0 | 15.4 |
| 2021(1265) | 77.2 | 19.4 | 4.2 | 1 | 11.1 | 12.9 | 15.2 | 0 | 0.9 | 20.7 |
| NSAR2020 | 78.9 | | 3.5 | 0.9 | 1 | 6.8 | 11.4 | 0.3 | | 8.6 |

**Figure 3: Antibiotic resistance trend for MSSA isolated from all samples against selective antibiotics**

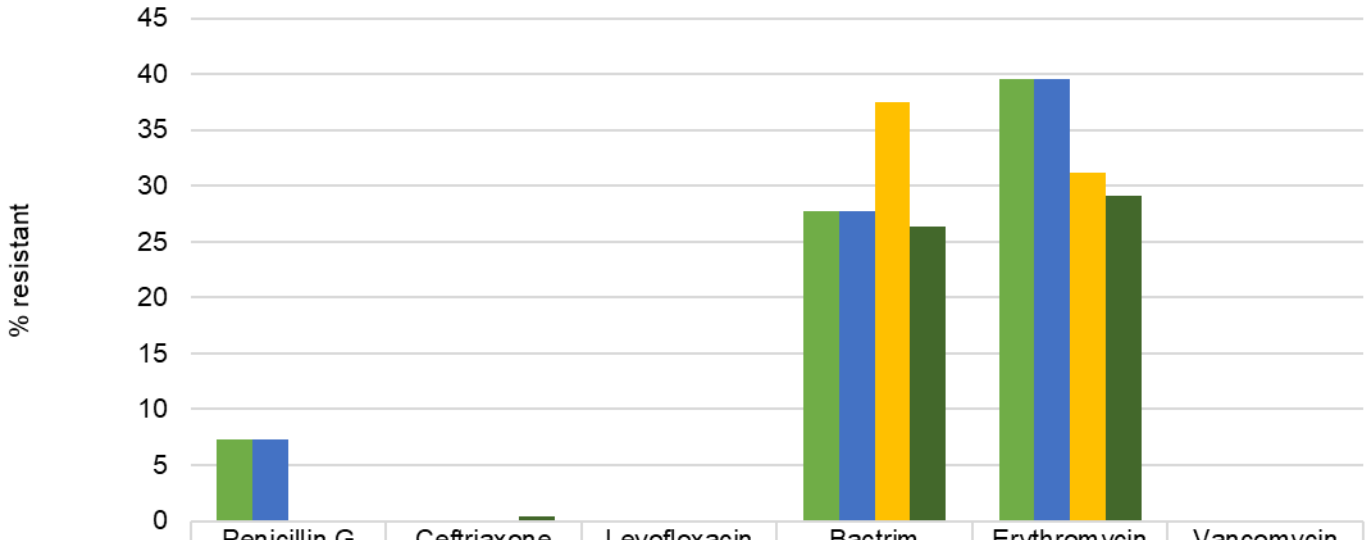
**MRSA**




| | Gentamicin | Rifampin | Bactrim | Clindamycin | Erythromycin | Linezolid | Vancomycin | Fusidic acid |
|---|---|---|---|---|---|---|---|---|
| 2019(346) | 12.4 | 1.4 | 6.6 | 60.1 | 70.8 | 0 | 0 | 22.3 |
| 2020(271) | 7.5 | 2.6 | 1.3 | 60.1 | 71.1 | 0 | 0 | 29.9 |
| 2021(250) | 9.8 | 3.1 | 3.1 | 61.4 | 70.2 | 0 | 0 | 48.7 |
| NSAR 2020 | 10.8 | 3.7 | 3.4 | 37.2 | 56.7 | 0.1 | | 15.3 |

**Figure 4: Antibiotic resistance trend for MRSA isolated from all samples against selective antibiotics**

## 2. *Streptococcus pneumoniae*




| | Penicillin G | Ceftriaxone | Levofloxacin | Bactrim | Erythromycin | Vancomycin |
|---|---|---|---|---|---|---|
| 2019(50) | 7.3 | 0 | 0 | 27.7 | 39.6 | 0 |
| 2020(11) | 7.3 | 0 | 0 | 27.7 | 39.6 | 0 |
| 2021(20) | 0 | 0 | 0 | 37.5 | 31.2 | 0 |
| NSAR 2020 | 0 | 0.4 | | 26.4 | 29.1 | 0 |

**Figure 5: Antibiotic resistance trend for *Streptococcus pneumoniae* isolated from all samples against selective antibiotics**

### 3. *Enterococcus faecium*

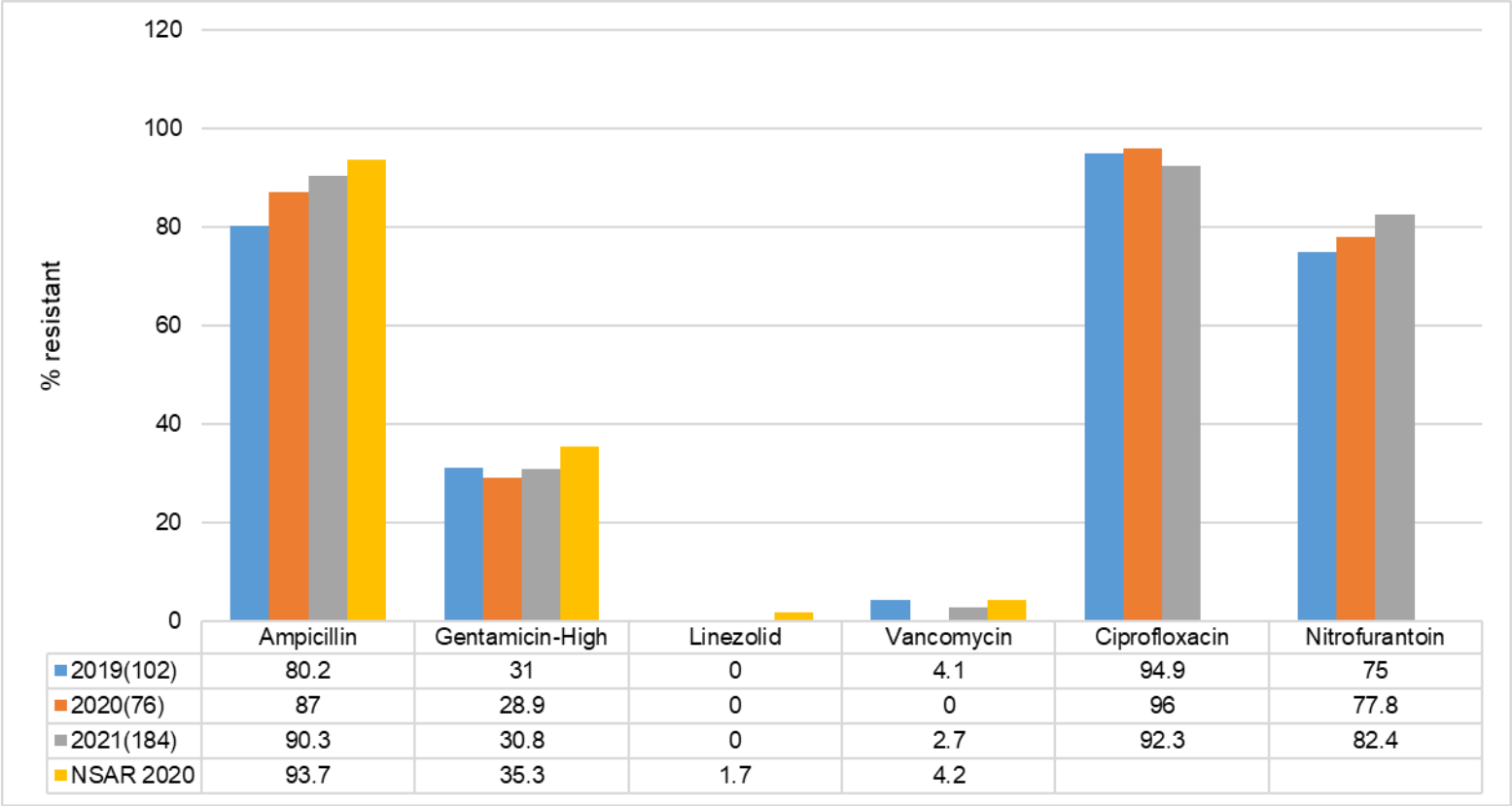
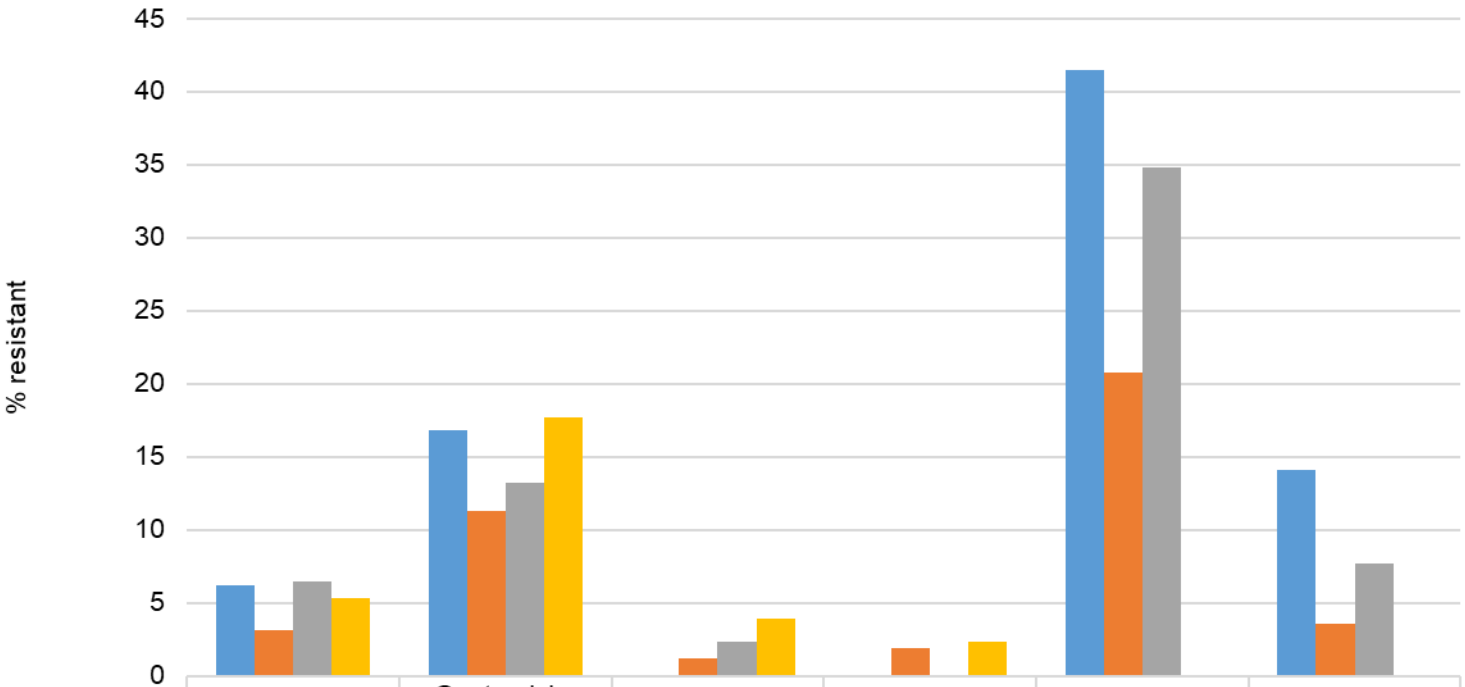



**Figure 6: Antibiotic resistance trend for *Enterococcus faecium* isolated from all samples against selective antibiotics**

## 4. *Enterococcus faecalis*

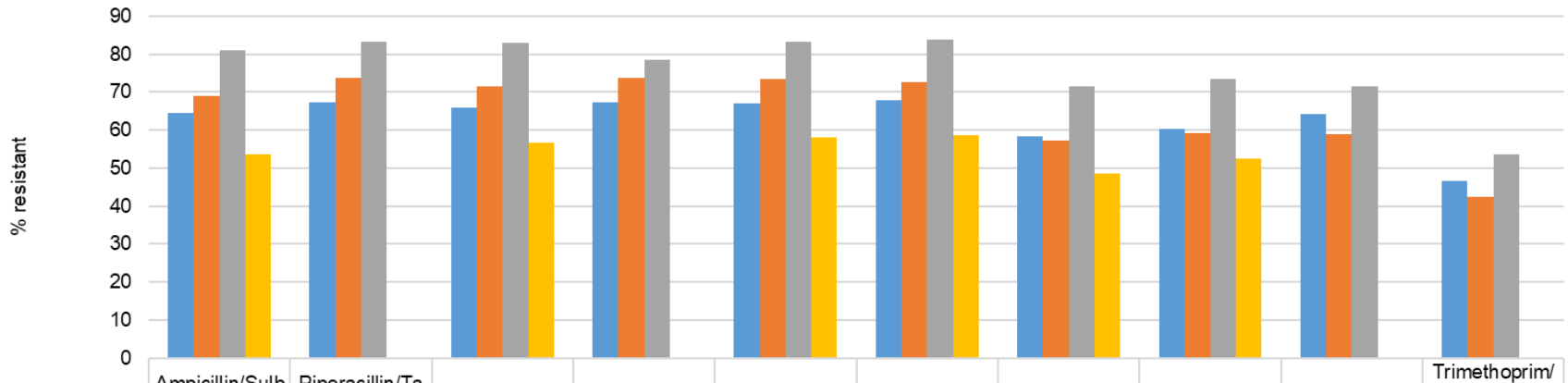



| | Ampicillin | Gentamicin-High | Linezolid | Vancomycin | Ciprofloxacin | Nitrofurantoin |
|---|---|---|---|---|---|---|
| 2019(211) | 6.2 | 16.8 | 0 | 0 | 41.5 | 14.1 |
| 2020(182) | 3.1 | 11.3 | 1.2 | 1.9 | 20.8 | 3.6 |
| 2021(229) | 6.5 | 13.2 | 2.3 | 0 | 34.8 | 7.7 |
| NSAR 2020 | 5.3 | 17.7 | 3.9 | 2.3 | | |

**Figure 7: Antibiotic resistance trend for *Enterococcus faecalis* isolated from all samples against selective antibiotics**

***Gram-negative bacteria***

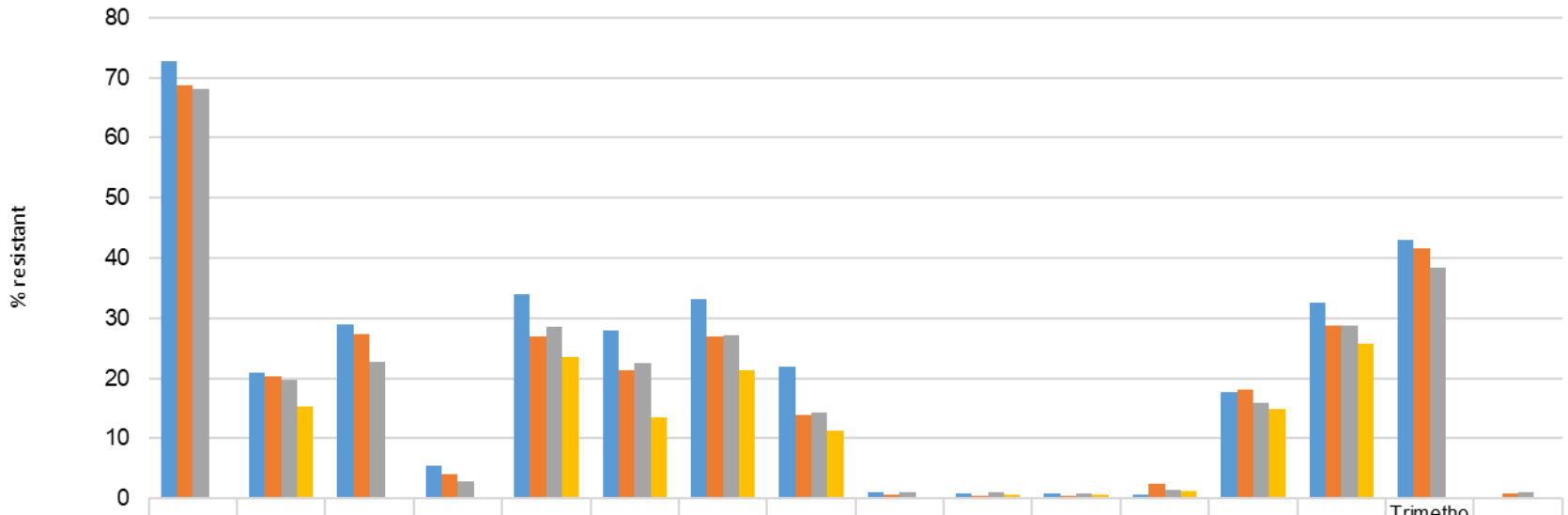
## 1. *Acinetobacter baumannii*




| | Ampicillin/Sulbactam | Piperacillin/Tazobactam | Ceftazidime | Cefepime | Imipenem | Meropenem | Amikacin | Gentamicin | Ciprofloxacin | Trimethoprim/ Sulfamethoxazole |
|---|---|---|---|---|---|---|---|---|---|---|
| 2019(558) | 64.6 | 67.2 | 66 | 67.4 | 67 | 67.8 | 58.3 | 60.2 | 64.3 | 46.5 |
| 2020(394) | 69.1 | 73.7 | 71.5 | 73.9 | 73.4 | 72.7 | 57.3 | 59.3 | 59 | 42.5 |
| 2021(523) | 81.1 | 83.4 | 83.1 | 78.6 | 83.3 | 83.7 | 71.4 | 73.4 | 71.4 | 53.6 |
| NASR 2020 | 53.6 | | 56.8 | | 58.1 | 58.7 | 48.5 | 52.5 | | |

**Figure 8: Antibiotic resistance trend for *Acinetobacter baumannii* isolated from all samples against selective antibiotics**

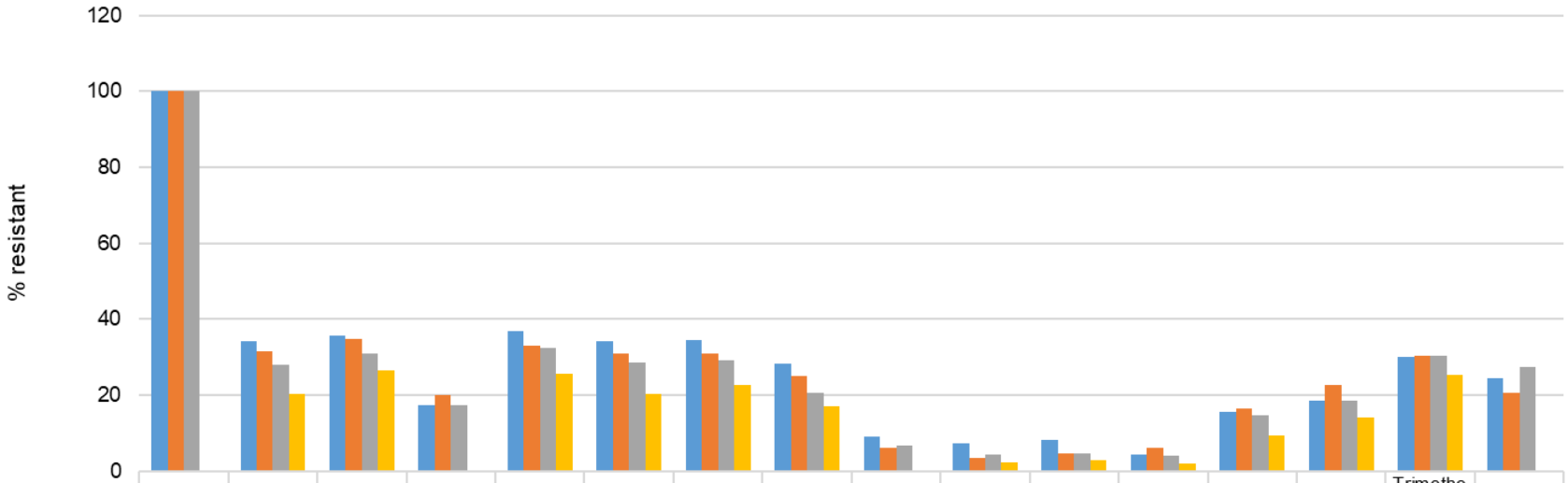
## 2. *Escherichia coli*




| | Ampicillin | Amoxicillin/Clavulanic acid | Ampicillin/Sulbactam | Piperacillin/Tazobactam | Cefuroxime | Ceftazidime | Cefotaxime | Cefepime | Ertapenem | Imipenem | Meropenem | Amikacin | Gentamicin | Ciprofloxacin | Trimethoprim/Sulfamethoxazole | Nitrofurantoin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019(1495) | 72.8 | 21 | 28.9 | 5.5 | 34 | 27.9 | 33.2 | 21.9 | 1 | 0.9 | 0.9 | 0.6 | 17.7 | 32.6 | 43.1 | 0.2 |
| 2020(948) | 68.7 | 20.4 | 27.4 | 4 | 26.9 | 21.3 | 27 | 14 | 0.7 | 0.4 | 0.5 | 2.5 | 18.2 | 28.8 | 41.6 | 0.9 |
| 2021(1238) | 68.1 | 19.8 | 22.8 | 2.9 | 28.5 | 22.5 | 27.1 | 14.3 | 1 | 1.1 | 0.9 | 1.5 | 16 | 28.8 | 38.5 | 1.1 |
| NSAR 2020 | | 15.3 | | | 23.6 | 13.6 | 21.4 | 11.3 | | 0.7 | 0.7 | 1.2 | 14.9 | 25.8 | | |

**Figure 9: Antibiotic resistance trend for *Escherichia coli* isolated from all samples against selective antibiotics**

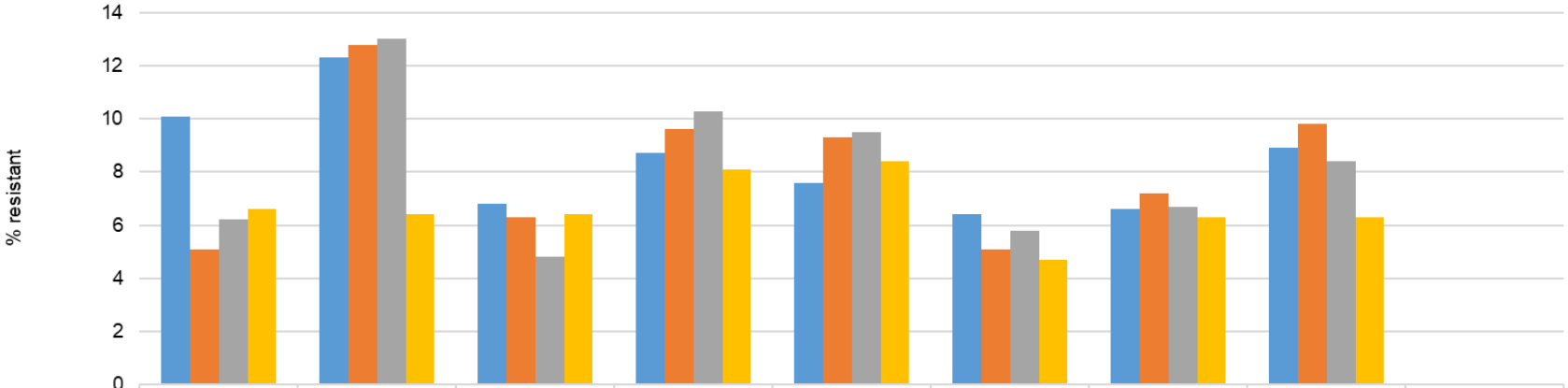
## 3. *Klebsiella pneumoniae*




| | Ampicillin | Amoxicillin/Clavulanic acid | Ampicillin/Sulbactam | Piperacillin/Tazobactam | Cefuroxime | Ceftazidime | Cefotaxime | Cefepime | Ertapenem | Imipenem | Meropenem | Amikacin | Gentamicin | Ciprofloxacin | Trimethoprim/Sulfamethoxazole | Nitrofurantoin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019(1437) | 100 | 34.2 | 35.6 | 17.4 | 36.9 | 34.2 | 34.6 | 28.2 | 9 | 7.3 | 8.3 | 4.5 | 15.6 | 18.6 | 30.2 | 24.6 |
| 2020(1014) | 100 | 31.6 | 34.9 | 20.1 | 33.1 | 31.1 | 31.1 | 25.1 | 6.2 | 3.5 | 4.6 | 6.2 | 16.4 | 22.7 | 30.5 | 20.5 |
| 2021 (1102) | 100 | 28.1 | 30.9 | 17.5 | 32.3 | 28.5 | 29.1 | 20.7 | 6.6 | 4.5 | 4.7 | 4 | 14.6 | 18.6 | 30.4 | 27.3 |
| NSAR 2020 | | 20.4 | 26.5 | | 25.7 | 20.4 | 22.6 | 17.1 | | 2.4 | 2.8 | 2 | 9.4 | 14 | 25.3 | |

**Figure 10: Antibiotic resistance trend for *Klebsiella pneumoniae* isolated from all samples against selective antibiotics**

## 4. *Pseudomonas aeruginosa*

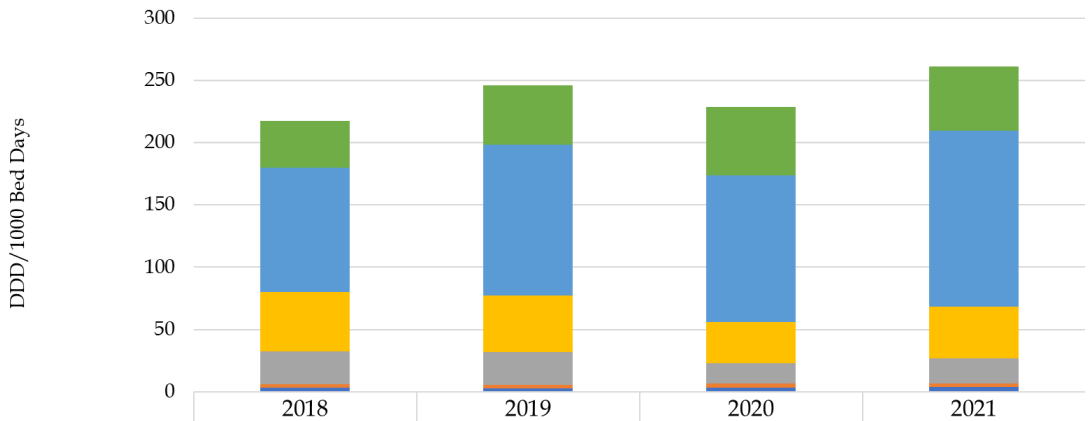



| | Piperacillin/Tazobactam | Ceftazidime | Cefepime | Imipenem | Meropenem | Amikacin | Gentamicin | Ciprofloxacin | Polymixin B |
|---|---|---|---|---|---|---|---|---|---|
| 2019(865) | 10.1 | 12.3 | 6.8 | 8.7 | 7.6 | 6.4 | 6.6 | 8.9 | 0 |
| 2020(727) | 5.1 | 12.8 | 6.3 | 9.6 | 9.3 | 5.1 | 7.2 | 9.8 | 0 |
| 2021(830) | 6.2 | 13 | 4.8 | 10.3 | 9.5 | 5.8 | 6.7 | 8.4 | 0 |
| NSAR 2020 | 6.6 | 6.4 | 6.4 | 8.1 | 8.4 | 4.7 | 6.3 | 6.3 | |

**Figure 11: Antibiotic resistance trend for *Pseudomonas aeruginosa* isolated from all samples against selective antibiotics**

## APPENDIX 2: ANTIBIOTIC UTILISATION DATA (2018 TO 2021)

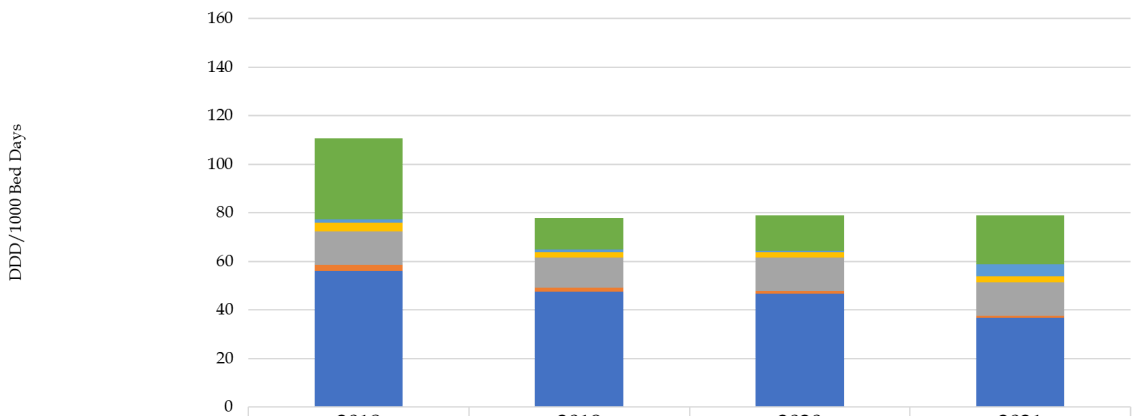
### 1. Penicillins




| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Piperacillin/Tazobactam | 37.49 | 47.82 | 54.99 | 51.31 |
| Ampicillin/Sulbactam | 100.18 | 121.02 | 118.00 | 141.32 |
| Amoxycillin/Clavulanate | 47.34 | 45.25 | 33.10 | 41.97 |
| Cloxacillin | 26.78 | 26.39 | 16.18 | 20.03 |
| Ampicillin | 2.77 | 2.86 | 3.66 | 2.92 |
| Benzylpenicillin | 2.94 | 2.81 | 3.00 | 3.53 |

**Figure 12: Utilisation of injection of the penicillin group**

### 2. Third- and fourth-generation cephalosporins




| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Cefepime | 33.37 | 13.11 | 14.72 | 20.17 |
| Cefoperazone/Sulbactam | 1.35 | 0.87 | 0.38 | 4.94 |
| Cefoperazone | 3.61 | 2.41 | 2.14 | 2.49 |
| Ceftazidime | 13.71 | 12.35 | 14.03 | 13.80 |
| Cefotaxime | 2.37 | 1.52 | 1.11 | 0.80 |
| Ceftriaxone | 56.20 | 47.68 | 46.61 | 36.95 |

**Figure 13: Utilisation of cephalosporin injection**

## 3. Carbapenems

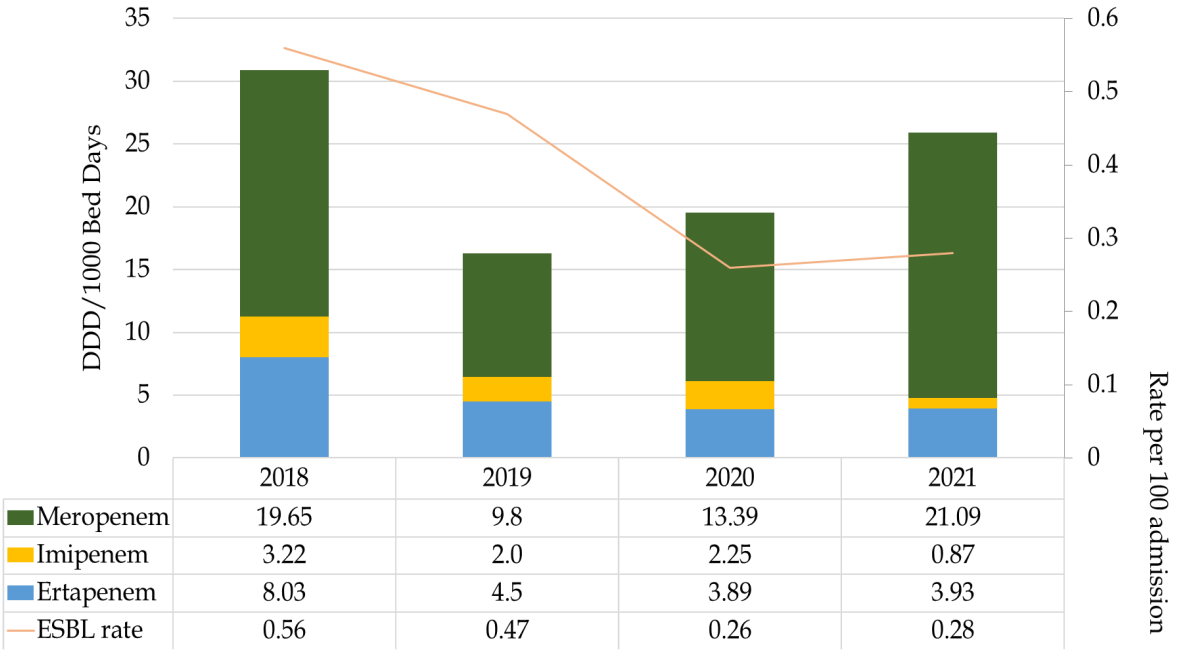



**Figure 14: Utilisation of carbapenem injection vs rate of ESBL infection**

## 4. Polymyxins

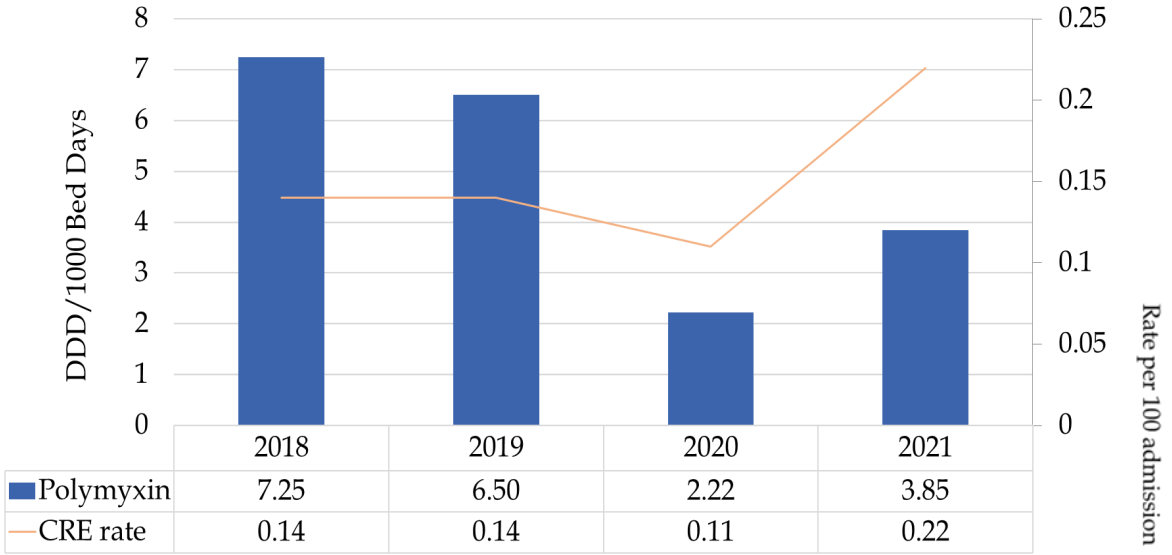
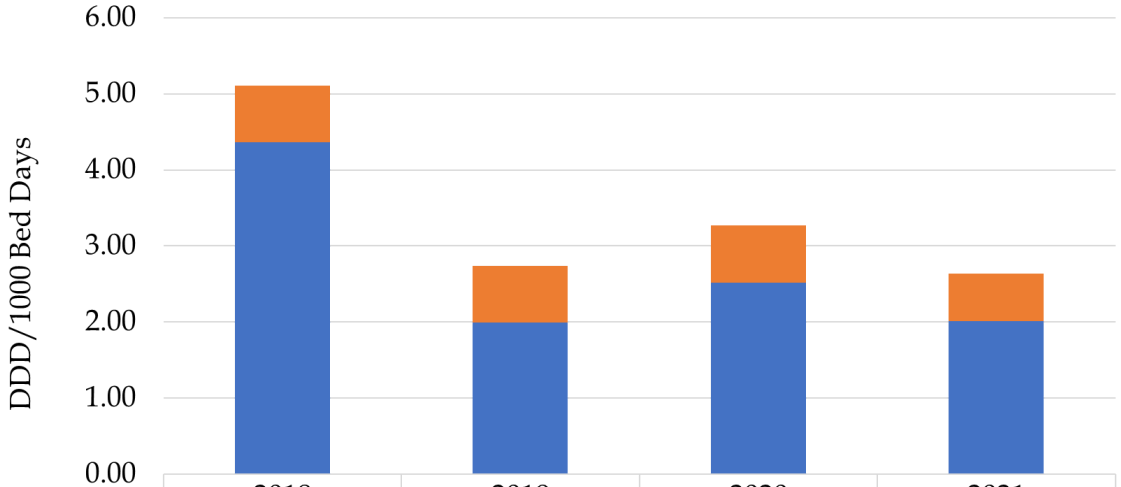



**Figure 15: Utilisation of polymyxin injection vs rate of CRE infection**

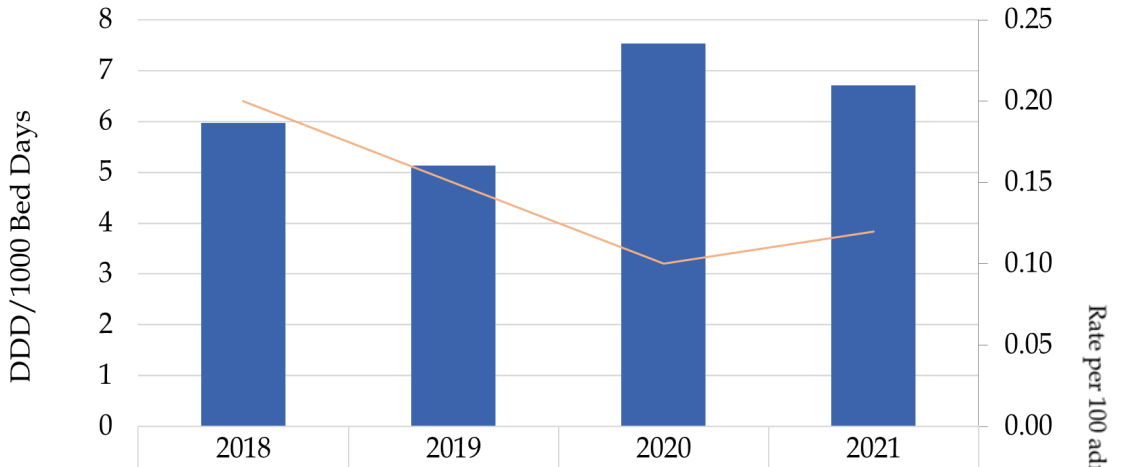
## 5. Fluoroquinolones




| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Levofloxacin | 0.74 | 0.75 | 0.75 | 0.63 |
| Ciprofloxacin | 4.37 | 1.99 | 2.52 | 2.01 |

**Figure 16: Utilisation of fluoroquinolone injection**

## 6. Vancomycin




| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Vancomycin | 5.97 | 5.13 | 7.54 | 6.71 |
| MRSA rate | 0.20 | 0.15 | 0.10 | 0.12 |

**Figure 15: Utilisation of vancomycin injection vs rate of MRSA infection**

**APPENDIX 3: ANTIMICROBIAL DOSAGES IN PATIENTS WITH IMPAIRED RENAL FUNCTION (ADULTS)**

The Cockcroft-Gault equation estimates creatinine clearance (CrCl) in mL/minute and has been successfully used in the calculation of adults with renal impairment. Weight, age, gender and serum creatinine are required. The formula below should not be used to estimate CrCl in severe renal insufficiency, or with rapidly changing renal function.

(i) Modified Cockcroft-Gault equation:

$$CrCl\ (mL/min) = \frac{(140-age)\times IBW\ (kg)}{Serum\ creatinine\ (\mu mol/L)} \times (1.04\ for\ females)\ or\ (1.23\ for\ males)$$

*If actual body weight (ABW) is < ideal body weight (IBW), use actual body weight (ABW)

(ii) Ideal body weight calculation:

Males: IBW (kg) = 50kg + 2.3kg for each inch over 5 feet

Females: IBW(kg) = 45.5kg + 2.3kg for each inch over 5 feet

*Use IBW if overweight but non-obese

(iii) Dosing weight calculation:

Dosing weight (DW) = IBW + [0.4 x (ABW – IBW)]

*Use DW if obesity (ABW ≥ 125% of IBW)

## ANTIMICROBIAL DOSAGES IN PATIENTS WITH IMPAIRED RENAL FUNCTION (ADULTS)

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

*** For critical care patients, kindly refer to Guide to Antimicrobial Therapy in the Adult ICU 2017 page 123-131 for dosage adjustment for renal impairment.*

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| **ANTIBACTERIAL** | | | | | | |
| **(A) Aminoglycosides** | | | | | | |
| Amikacin | 7.5mg/kg q12h | 100% of normal dose q12h or 24hr by levels | 100% of normal dose q24-72h by levels | 100% of normal dose q48h-72h by levels | HD: 7.5mg/kg q48h post HD | Dosage adjustment should be based on TDM level where possible. |
| Gentamicin | LD: 2mg/kg; MD: 1.7-2mg/kg q8h | 100% of normal dose q8h by levels | 100% of normal dose q12-48h by levels | 100% of normal dose q48h by levels | HD: 1.7-2mg/kg q48h post HD | Dosage adjustment should be based on TDM level where possible. |
| Streptomycin (IM) | 15mg/kg (max. 1gm) q24h **OR** 25-30mg/kg 2x/week **OR** 25-30mg/kg 3x/week | 100% of normal dose q24h | 100% of normal dose q24-72h | 100% of normal dose q72-96h | HD: 15mg/kg q72-96h post HD | |
| **(B) Carbapenems** | | | | | | |
| Imipenem | **Normal dose** | **CrCl (mL/min/1.73 m²)** | | | HD: 250-500mg q12h | |
| | | **≥ 60** | **≥ 30 to < 60** | **≥ 15 to < 30** / **< 15** | | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| | 500mg q6h | 100% of normal dose q6h | 250mg q6h **OR** 500mg q8h | 250mg q8h **OR** 500mg q12h | 500mg BD *as long as HD will be started within 48hrs | |
| | 1000mg q8h | 100% of normal dose q8h | 500mg q8h | 250mg q8h **OR** 500mg q12h | | |
| | 1000mg q6h | 100% of normal dose q6h | 500mg q6h | 250mg q6h | | |
| Meropenem | 1-2g q8h | 100% of normal dose q8h | 26-50mL/min: 100% of normal dose q12h<br><br>10-25mL/min: 50% of normal dose q12h | 50% of normal dose q24h | CAPD, HD: 500mg 24h | |
| Ertapenem | 1g q24h | 100% of normal dose q24h | <30 mL/min: 50% of normal dose q24h | 50% of normal dose q24h | CAPD, HD: 500mg q24h | If dosed <6 hours prior to HD, to give 150mg supplemental dose after dialysis. |
| **(C) Cephalosporins** | | | | | | |
| Cefazolin (IV/IM) | 1-2g q8h (max 12g/day) | 100% of normal dose q8h | 100% of normal dose q12h | 50% of normal dose q24-48h | HD: 1-2g q24h | |
| Cefepime | 1-2g q8-12h | 100% of normal dose q12h | 50-100% of normal dose q24h | 25-50% of normal dose q24h | HD: 1g q24h (+ extra 1g post HD) | For continuous infusion, start with LD of 15mg/kg IV over 30 minutes and then immediately begin the continuous infusion: |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| | | | | | | CrCl: Dose<br>>60: 6g q24h<br>30-60: 4g q24h<br>11-29: 2g q24h |
| Cefotaxime | 2g q8h | 100% of normal dose q8-12h | 100% of normal dose q12-24h | 100% of normal dose q24h | HD: 2g q24h | |
| Cefoperazone | 1-2g q12h | 100% of normal dose q12h | 100% of normal dose q12h | 100% of normal dose q12h | | Max dose 4g/day for patients who CrCl < 18mL/min or serum creatinine > 309µmol/L |
| Ceftazidime | 2g q8h | 100% of normal dose q8-12h | 100% of normal dose q12-24h | 100% of normal dose q24-48h | HD: 2g q24-48h | For continuous infusion, start with LD of 15mg/kg IV over 30 minutes and then immediately begin the continuous infusion:<br>CrCl: Dose<br>>60: 6g q24h<br>30-60: 4g q24h<br>11-29: 2g q24h |
| Cefuroxime sodium (IV) | 750-1500mg q8h | 100% of normal dose q8h | 10-30mL/min: 100% of normal dose q12h | 100% of normal dose q24h | CAPD, HD: 750-1500mg q24h | In more serious infection, can increase to IV 1500mg q6h |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| Cefuroxime axetil (PO) | 250mg-500mg q12h | 100% of normal dose q12h | 10-30mL/min: 250mg q12h **OR** 250-500mg q24h | 250mg q24h **OR** 250-500mg q48h | CAPD, HD: 250mg q24h **OR** 250-500mg q48h | |
| **(D) Fluoroquinolones** | | | | | | |
| Ciprofloxacin (IV) | 400mg q12h | 100% of normal dose q12h | 100% of normal dose q24h | 100% of normal dose q24h **OR** 50% of normal dose q12h | HD: 400mg IV q24h | |
| Ciprofloxacin (PO) | 500-750mg q12h | 100% of normal dose q12h | 30-50mL/min: 250-500mg q12hr<br><br>10-30mL/min: 500mg q24h | 500mg q24h | CAPD, HD: 250-500mg q24h | |
| Levofloxacin (IV/PO) | 750mg q24h | 100% of normal dose q24h | 20-49mL/min: 100% of normal dose q48h | < 20 mL/min: 750mg q24h then 500mg q48h | CAPD, HD: 750mg q24h then 500mg q48h | |
| Ofloxacin (PO) | 200-400mg q12h | 100% of normal dose q12h | 100% of normal dose q24h | 200mg q24h | HD: 200mg q24h | |
| **(E) Macrolides** | | | | | | |
| Clarithromycin (PO) | 500mg q12h | 100% of normal dose q12h | 50-100% of normal dose q12h | 50-75% of normal dose q12h | CAPD, HD: 500mg q24h | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| **(F) Miscellaneous Antibacterials** | | | | | | |
| Colistin | LD (regardless of renal function):<br>IBW > 75kg: 9 MU<br>IBW 61-74kg: 8 MU<br>IBW 51-60kg: 7 MU<br>IBW < 50kg: 6 MU<br><br>MD:<br>Based on renal function | 4.5 MU q12h | 30-50mL/min: 3 MU q12h<br><br>10-30mL/min: 2.5 MU q12h | 2 MU q12h | HD: 2 MU q12h (+ extra 1.5 MU as supplemental dose post HD) | |
| Linezolid (IV/PO) | 600mg q12h | 100% of normal dose q12h | 100% of normal dose q12h | 100% of normal dose q12h | CAPD: No dosage adjustment<br><br>HD: No dose adjustment, but administer one of the dose post HD | |
| Metronidazole | 250-500mg q8-12h | 100% of normal dose q8-12h | 100% of normal dose q8-12h | 100% of normal dose q8-12h | CAPD, HD: 7.5mg/kg q12h | |
| Nitrofurantoin (PO) | UTI treatment: 50-100mg q6h<br><br>UTI Prophylaxis: 50-100mg at night | Avoid use when CrCl < 60mL/min | Avoid use | Avoid use | Avoid use | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | **> 50** | **10-50** | **<10** | | |
| Trimethoprim (TMP)/sulfamethoxazole (SMZ) (IV/PO)<br>TMP 80mg:<br>SMZ 4000mg | 5-20mg/kg/day (TMP) (divided q6-12h) | 100% of normal dose (divided q6-12h) | 10-29mL/min: 5-10mg/kg/day (divided q12h) | 5-10mg/kg q24h | | |
| Vancomycin | | | | | | Maximum loading dose<br>1. Normal body weight: 2g/dose<br>2. Obese (BMI ≥ 30kg/m²): 3g/dose<br><br>*Suggestion for 30mg/kg in seriously ill patients |

| CrCl (mL/min) | Loading Dose (LD) | Initial Maintenance Dose (MD) | Dosing Interval |
|---|---|---|---|
| **> 90** | 25-30mg/kg* | 15-20mg/kg | q8-12h |
| **50 - 90** | 20-25mg/kg | 15-20mg/kg | q12h |
| **20 - 49** | 20-25mg/kg | 10-15mg/kg | q24h |
| **< 20** | 20-25mg/kg | Dosage adjustment according to TDM level | |
| **HD** | 25mg/kg | Dosage adjustment according to TDM level | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **(G) Penicillins** | | | | | | |
| Amoxicillin (PO) | 250-1000mg q8h | 100% of normal dose q8h | 100% of normal dose q8-12h | 100% of normal dose q24h | HD: 250-500mg post HD | |
| Ampicillin sodium | 1-2g q4-6h | 100% of normal dose q4-6h | 30-50mL/min: 100% of normal dose q6-8h<br><br>10-30mL/min: 100% of normal dose q8-12h | 100% of normal dose q12h | HD: 1-2g q12h | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| Amoxicillin/clavulanate (IV) | 1.2g q8h<br>In serious infection can increase frequency up to q6h | 100% of normal dose q8h | 10-30mL/min: 1.2g first dose then 600mg q12h | 1.2g first dose then 600mg q12h | CAPD: No data<br><br>HD: 1.2g first dose then 600mg q12h | |
| Amoxicillin/clavulanate (PO) | 500/125mg q8h | 100% of normal dose q8h | >30mL/min: 100% of normal dose q8h<br><br>10-30mL/min: 100% of normal dose q12h | 100% of normal dose q24h | HD: 625mg q24h post HD | |
| Ampicillin/sulbactam (IV) | 3g q6h | 100% of normal dose q6h | 15-29mL/min: 100% of normal dose q12h | < 15mL/min: 100% of normal dose q24h | CAPD: 3g q12h<br>HD: 3g q24h post HD | |
| Benzylpenicillin | 0.5-4MU q4-6h | 100% of normal dose q4-6h | 75% of normal dose q4-6h | 20-50% of normal dose q4-6h | HD: Normal dose first dose then 25-50% of normal dose q4-6h<br>**OR**<br>50-100% of normal dose q8-12h | |
| Piperacillin/tazobactam | 3.375-4.5g q6h | 100% of normal dose q6h | 20-40mL/min: 2.25g-3.375g q6h<br><br><20mL/min: 2.25g-3.375g q8h | 2.25g q6-8h | HD: 2.25g q8-12h | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| **ANTIFUNGAL** | | | | | | |
| Amphotericin | Amphotericin B Test dose 1mg: starting 0.1mg/kg/day over 6 hours; increase to target dose 0.25-1mg/kg q24h (over 2-6h) | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency | |
| | Amphotericin, colloidal dispersion 3-6mg/kg q24h | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency | |
| | Amphotericin, lipid complex 5mg/kg/day as single infusion | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency | 100% of normal dose. No changes in frequency | 100% of normal dose. No changes in frequency | |
| | Amphotericin, liposomal 1-5mg/kg/day as single infusion | 100% of normal dose. No changes in frequency | 100% of normal dose. No changes in frequency | 100% of normal dose. No changes in frequency | 100% of normal dose. No changes in frequency | |
| Fluconazole (IV/PO) | 100-400mg q24h | 100% of normal dose q24h | 50% of normal dose q24h | 50% of normal dose q24h | CAPD: 200mg then 50-100mg q24h<br><br>HD: 100-400mg q24h | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| Flucytosine | 25mg/kg q6h | > 40mL/min: 100% of normal dose q6h | 21-40mL/min: 100% of normal dose q12h<br><br>10-20mL/min: 100% of normal dose q24h | 100 % of normal dose q48h | HD: 25-50mg/kg q48-72h post HD | |
| Itraconazole (IV) | 200mg q12h for 4 doses, then 200mg q24h | 100% of normal dose. No changes in frequency. | <30mL/min: Avoid | Avoid | Avoid | IV formulation is contraindicated for CrCl <30mL/min due to accumulation of cyclodextrin vehicle) |
| Itraconazole (PO) | 100-200mg q12h | 100% of normal dose q12h | 100% of normal dose q12h | 50% of normal dose q12h | CAPD, HD: 100mg q12-24h | |
| Voriconazole (IV) | 6mg/kg q12h for 2 doses, then 4mg/kg q12h | 100% of normal dose. No changes in frequency. | Switch to PO or suspension (IV formulation is contraindicated for CrCl <30mL/min due to accumulation of cyclodextrin vehicle) | | | |
| Voriconazole (PO) | >40kg: 400mg PO q12h x2 doses, then 200mg PO q12h<br><40kg: 200mg PO q12h x2 doses, then 100mg PO q12h | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | CAPD, HD: No data, but prefer oral route to avoid accumulation of IV cyclodextrin vehicle | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| **ANTIPARASITIC** | | | | | | |
| Pentamidine (IV) | IV/IM 4mg/kg q24h | 100% of normal dose q24h | 100% of normal dose q24h | 100% of normal dose q24-36h | CAPD: 4mg/kg q24-36h<br>HD: 4mg/kg q48h | |
| **ANTIMYCOBACTERIAL** | | | | | | |
| Ethambutol | 15-25mg/kg q24h (max 1600mg/day) | 100% of normal dose q24h | 30-50mL/min: 100% normal dose q24-36h<br><br>15-25mL/min: 100% of normal dose q36-48h | 15mg/kg q48h | CAPD, HD: 15mg/kg q48h | |
| Isoniazid (PO) | 5mg/kg q24h (max 300mg/day) | 100% of normal dose q24h | 100% of normal dose q24h | 100% of normal dose q24h | HD: 5mg/kg q24h | |
| Pyrazinamide (PO) | 25mg/kg q24h (max 2500mg/day) | 100% of normal dose q24h | 10-20mL/min: 100% of normal dose q48h | 100% of normal dose q48h | CAPD: 25mg/kg q24h<br>HD: 25mg/kg q48h | |
| Rifampin (PO) | 10mg/kg q24h (max 600mg/day) | 100% of normal dose q24h | 50-100% of normal dose q24h | 50-100% of normal dose q24h | CAPD, HD: 300-600mg q24h | |
| Ethionamide (PO) | 15-20mg/kg/day in 1-3 divided doses | 100% of normal dose. No changes in frequency. | 100% of normal dose. No changes in frequency. | 50% of normal dose. No changes in frequency. | CAPD, HD: 50% of normal dose. No | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| | (max 1000mg/day) | | | | changes in frequency. | |
| **ANTIVIRAL** | | | | | | |
| Acyclovir | 5-12.5mg/kg q8h | 100% of normal dose q8h | 100% of normal dose q12-24h | 5-6.25mg/kg q24h | CAPD, HD: 2.5-6.25mg/kg q24h | |
| Ganciclovir (IV) | Induction: 5mg/kg q12h Maintenance: 5mg/kg q24h **OR** 6mg/kg 5 times weekly | 50-69mL/min: 50% of normal dose q12h | 25-49mL/min: 50% of normal dose q24h<br><br>10-24mL/min: 25% of normal dose q24h | 25% of normal dose 3x/week | CAPD, HD: 1.25mg/kg 3x/week | |
| Valganciclovir (PO) | Induction: 900mg q12h | ≥60mL/min: 900mg q12h<br>40-59mL/min: 450mg q12h<br>25-39mL/min: 450mg q24h<br>10-24mL/min: 450mg q48h | | Avoid use | | |
| | Maintenance (prophylaxis): 900mg q24h | ≥60mL/min: 900mg q24h<br>40-59mL/min: 450mg q24h<br>25-39mL/min: 450mg q48h<br>10-24mL/min: 450mg twice weekly | | Avoid use | | |
| Lamivudine (HIV) (PO) | 300mg q24h | 100% of normal dose q24h | 300mg first dose; then 50-150mg q24h | 50mg first dose; then 25-50mg q24h | CAPD, HD: 25-50mg q24h | |

| ANTIMICROBIAL | DOSE FOR NORMAL RENAL FUNCTION | ADJUSTMENT FOR RENAL FAILURE Estimated Creatinine Clearance (CrCl), mL/min | | | DIALYSIS DOSE | COMMENTS |
|---|---|---|---|---|---|---|
| | | > 50 | 10-50 | <10 | | |
| Zidovudine | 300mg q12h | 100% of normal dose q12h | 100% of normal dose q12h | 100% of normal dose q24h or 100mg q8h | HD: 100mg q8h or 300mg q24h<br><br>CAPD: 100mg q8h | |

HD = Hemodialysis; CAPD = Continuous Peritoneal Dialysis; LD = Loading Dose; MD: Maintenance Dose; IV = Intravenous; IM = Intramuscular; PO = Oral

**References:**


1. The Sanford Guide to Antimicrobial Therapy 2022.
2. The Renal Drug Handbook 5th Edition.
3. ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment.
4. Guide to Antimicrobial Therapy in the Adult ICU 2017.
5. Micromedex (online).
6. Lexicomp (online).

## APPENDIX 4: CLINICAL PHARMACOKINETICS GUIDELINES (AMINOGLYCOSIDES AND VANCOMYCIN)

### I. 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]
- Optimize 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).
- Hemodynamically 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]

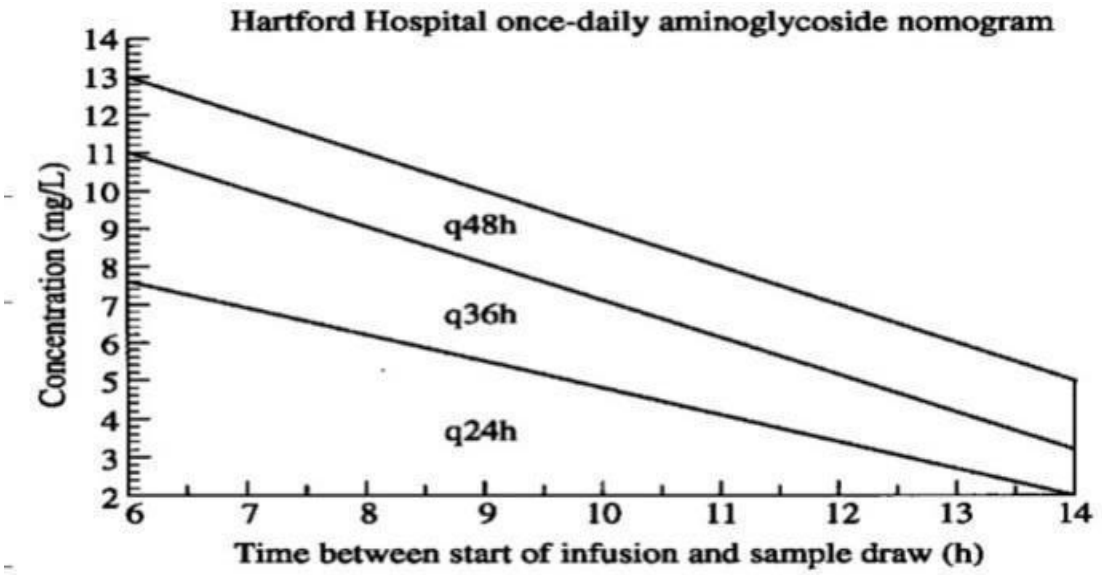
| Gentamicin | Amikacin |
|---|---|
| 7mg/kg per dose | 15mg/kg per dose |

**1. Initial level monitoring***

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

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

***Please consult pharmacists for dosage adjustment.***




**2. Follow up trough level**

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* |
| | Adult: **< 1 mcg/ml**<br>Children: **< 1 mcg/ml**<br>IP: **< 3 mcg/ml** | Adult: **10-20 mcg/ml**<br>Children: **5-12 mcg/ml** | Adult: **< 5 mcg/ml**<br>Children: **< 5 mcg/ml**<br>IP: **< 15 mcg/ml** | Adult: **20-60 mcg/ml**<br>Children: **20-30 mcg/ml** |

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

## B. CONVENTIONAL/TRADITIONAL DOSING

Traditional dosing includes reduced doses and frequent administration of aminoglycosides using pharmacokinetic parameters to determine dose and frequency. However, in practice, dose below 7mg/kg for Gentamicin at 24 hours interval is frequently used for patients with normal renal function.

| **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<br>Continuous: Loading dose 8mg/L followed by 4mg/L | Intermittent: 2mg/kg in night dwell<br>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<br>**OR**<br>within 30 minutes before the next dose<br><br>**POST:** 30 minutes after completion of 30 minutes infusion<br>**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.*

**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 Antibiotics. 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.

## II. THERAPEUTIC DRUG MONITORING PROTOCOL FOR EXTENDED-INTERVAL GENTAMICIN IN NEONATES

Gentamicin initial empiric dosage regimen is 5mg/kg [1,2] Q36H

Sampling time: post 22 hours[2], or 30 minutes prior second dose[1,3]

**Nomogram for sampling post 22 hours[2]**

| **Suggested Gentamicin Dosing Interval Based on 22-Hour Concentration [2]** | |
|---|---|
| Concentration at 22 hours, mg/L | Suggested Dosing Regime, |
| **<1.2** | 5mg/kg, Q24H |
| **1.3-2.6** | 5mg/kg, Q36H |
| **2.7-3.5** | 5mg/kg, Q48H |
| **>3.6** | *Hold dose, repeat concentration in 24 hours* |

**Nomogram for sampling 30 minutes prior next dose[1,3]**

1. Therapeutic range:

Cmin: **<2mg/L** (pre-dose of second dose)
Cmin: **<1mg/L** (if more than 3 doses of gentamicin)

2. If Cmin ABOVE therapeutic range, repeat sampling by **ADDITIONAL 12 HOURS INTERVAL** from the last dose.

| Empirical interval | Repeat sampling |
|---|---|
| Q36H | 48 hours from last dose |

3. Recommendation of Dosing interval must be based on the time to withhold until Cmin in therapeutic range.
4. If intended Cmin is not available (eg. sampling error), **DO NOT WITHHOLD** the next dose unless there is evidence of renal dysfunction (for example: an elevated serum urea or creatinine concentration or anuria).
5. Repeat sampling EVERY THIRD DOSE (eg. 2nd dose, 5th dose, 8th dose etc).

**Cmax [1] (1 hour after dose administered)**

- Aim Cmax>8mg/L if neonate has Gram-negative or staphylococcal infection

Suggest Cmax sampling if:

1. Neonate with edema
2. Macrosomia (birthweight more than 4.5kg)
3. Unsatisfactory response to treatment
4. Proven Gram-negative infection.

**Note**:

1. Aim Cmax : MIC[3] = 8:1 to 10:1,an AUC 80-100mgh$^{-1}$L$^{-1}$
2. PAC= 4 hours after undetectable level of Cmin (<0.3mg/L) before redosing[5].
3. Potential advantage of Extended interval **similar** safety to traditional dosing.[4]
4. Serum creatinine **elevations by ≥ 50% from baseline** should investigate gentamicin induced nephrotoxicity.[3]
5. Demographic distribution for 5mg/kg Q36h

**Table 2.** Demographic data

| | *Group I (≤34 6/7 weeks of GA)* | | | *Group II (>35 0/7 weeks of GA)* | | |
|---|---|---|---|---|---|---|
| | *Control arm* | *Study arm* | P | *Control arm* | *Study arm* | P |
| *N* | 25 | 25 | | 23 | 23 | |
| Male, *n* (%) | 16 (64%) | 12 (48%) | 0.4 | 9 (39%) | 12 (52%) | 0.6 |
| GA, weeks (range) | 30.6 ± 3.1[a] (24–34) | 29 ± 3.7 (24–34) | 0.3 | 38.1 ± 2 (35–41) | 38 ± 1.7 (35–41) | 0.7 |
| PNA, days (range) | 3.4 ± 6.3 (1–26) | 6 ± 8.8[a] (1–32) | 0.09 | 1 ± 0.2 (1–2) | 1.4 ± 0.6 (1–3) | 0.01 |
| PCA, weeks (range) | 31.1 ± 2.7 (26–34.14) | 30.1 ± 3.3 (24.14–34.14) | 0.4 | 38.3 ± 2 (35.14–41.14) | 38.2 ± 1.8 (35.14–41.14) | 0.95 |
| Birth weight, kg (range) | 1.6 ± 0.6 (0.53–2.8) | 1.4 ± 0.7 (0.59–2.98) | 0.6 | 3.2 ± 0.4 (2.31–3.86) | 3.2 ± 0.5 (2.37–4.057) | 0.79 |

Abbreviations: GA, gestational age; PCA, postconceptional age; PNA, postnatal age. [a]Mean ± s.d.

6. Population pharmacokinetic profile

**Table 4.** Pharmacokinetic (PK) data

| *PK data* | *Group I (≤34 6/7 weeks of GA)* | | | *Group II (>35 0/7 weeks of GA)* | | |
|---|---|---|---|---|---|---|
| | *Control arm*, n = *25* | *Study arm*, n = *25* | P | *Control arm*, n = *23* | *Study arm*, n = *23* | P |
| $K_e$ | 0.074 ± 0.02[a] | 0.076 ± 0.02 | 0.83 | 0.093 ± 0.02 | 0.093 ± 0.02 | 0.629 |
| $t_{½}$ | 9.9 ± 2.4 | 9.8 ± 2.6 | 0.83 | 7.7 ± 1.4 | 7.7 ± 1.6 | 0.829 |
| $V_d$ (l kg$^{-1}$) | 0.5 ± 0.1 | 0.6 ± 0.1 | 0.69 | 0.5 ± 0.1 | 0.48 ± 0.1 | 0.688 |
| Cl (l h$^{-1}$ kg$^{-1}$) | 0.06 ± 0.02 | 0.06 ± 0.03 | 0.72 | 0.15 ± 0.04 | 0.14 ± 0.04 | 0.718 |

Abbreviations: Cl, clearance; GA, gestational age; $K_e$, elimination rate constant; $t_{½}$, half-life; $V_d$, volume of distribution. [a]Mean ± s.d.

**References:**


1. NICE Guidance, 2020. Neonatal Infection (early onset): antibiotics Treatment and Monitoring for Suspected or Confirmed Early-Onset Neonatal Infection.
2. Deonne, D, Akierman, A., Alshaikh,B. & Yusuf, K. 2012. Validation of a Dosage Individualization Table for Extended-Interval Gentamicin in Neonates. Neonatology (46) 935-942
3. El-Chaar, G.M., Supaswud-Franks, T., Venugopalan, L., Kohn, N. & Castro-Alcaraz, S. 2016. Extended-interval gentamicin administration in neonates: a simplified approach. Journal of Perinatology. 1-6.
4. Rao,S.C., Srinivasjois, R. Hagan, R. & Ahmed, M. 2011. One dose per day compare to multiple doses per day of gentamicin for treatment of suspected or proven sepsis in neonate. Cochrane Database syst Rev. 11: CD005091.
5. Zhanel,G.G.,Hoban,D.J.,Harding,G.K.M.1991.The postantibiotic effect: a review of in vitro and in vivo data. DICP. 25(2): 153-163.

## III. THERAPEUTIC DRUG MONITORING PROTOCOL FOR VANCOMYCIN FOR PATIENTS WITH COMPLICATED INVASIVE MRSA INFECTION ONLY*

*Defined as "including but not limited to bacteremia, sepsis, infective endocarditis, pneumonia, osteomyelitis and meningitis"[1]

**Intermittent Infusion [2, 3]:**

- Loading dose (using actual body weight, irrespective renal function)
  - Normal body weight : 20-35mg/kg over 1-2 hours (max: 3g/dose)
  - Obesity (BMI≥30kg/m$^2$) : 20-25mg/kg (max: 3g/dose)
- Maintenance dose (max: 4.5g/day):
  - 15-20mg/kg/dose frequency according to table below [3]:

| CrCL (mL/min) | Dosage Adjustment |
|---|---|
| >50 | bd |
| 20-49 | od |
| <20 | Dose per Vancomycin's level |

**SPECIAL POPULATION EMPIRIC DOSING REGIMEN [2,3]:**

**Critically ill:**

- Continuous Infusion:
  - Loading dose : 15-20mg/kg over 1-2 hours
  - Maintenance dose : 30-40mg/kg/day (max: 4.5g/day)

**Unstable Pharmacokinetic Parameter (AKI, Burn, Augmented renal function)**

- Loading dose (using actual body weight)
  - Normal body weight: 20-35mg/kg over 1-2 hours (max: 3g/dose)
- Maintenance dose:
  - 15-20mg/kg/dose frequency according to table below [3]:

| CrCL (mL/min) | Dosage Adjustment |
|---|---|
| >50 | bd |
| 20-49 | od |
| <20 | Dose per Vancomycin's level |

**Hemodialysis:**

- CRRT (effluent rate: 20-25ml/kg/h):
  - Loading dose: 20-25mg/kg
  - Maintenance dose: 7.5mg-10mg/kg/dose bd

- Hybrid (SLED)
    - Loading dose: 20-25mg/kg
    - 15mg/kg/ dose (dose per level)

- Intermittent Hemodialysis (thrice weekly dose administration)
    - Post HD (after dialysis end)
        - Low Flux:
            - Loading dose: 25mg/kg
            - Maintenance: 7.5mg/kg
        - High Flux:
            - Loading dose: 25mg/kg
            - Maintenance: 10mg/kg
    - Intradialytic (Last hour of HD)
        - Low Flux
            - Loading dose: 30mg/kg
            - Maintenance: 7.5-10mg/kg
        - High Flux
            - Loading dose: 35mg/kg
            - Maintenance: 10-15mg/kg

**EFFICACY PARAMETER [2,3]**

$AUC_{24}$/MIC: 400-600 mg.h/L
- Assume MIC=1 if MIC is not available
- AUC calculated based on past 24hours accumulation dose
- Must be at steady state

Cmin: 15-20mg/L
- For Intermittent Hemodialysis only
- Noninvasive OR uncomplicated MRSA OR non-MRSA organism

**TOXICODYNAMIC PARAMETERS [2]**
- $AUC_{24}$ >600mg.h/L
- Increase SCr in 23mcmol/L from baseline (according to AKIN, KDIGO criteria).

**DILUTION AND ADMINISTRATION [3,4]**
- Strength/unit: 500mg
- Reconstitution: 10ml Water for Injection
- Dilution for infusion: Normal saline / D5
- Rate of administration: 10-15mg/min
- Max concentration:
    - Non fluid restriction: ≤ 5mg/ml
    - Fluid restriction: ≤10mg/ml
- Stability:
    - Reconstituted: 14 days
    - Diluted:
        - Under refrigeration: 14 days

- Room temperature: 7 days

**References**:


1. CADTH Technology Review: Vancomycin Therapeutic Drug Monitoring for Serious Methicillin-Resistant *Staphylococcus aureus* infections.2020. Cuello,C. & Loshak, H.Canadian Agency of Drugs and Technologies in Health (CADTH).
2. Therapeutic monitoring of vancomycin for serious methicillin-resistant Staphylococcus aureus infections: A revised consensus guideline and review by the American Society of Health-System Pharmacists, the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society and the Society of Infectious Diseases Pharmacist. 2020. ASHP Report.
3. Clinical Pharmacokinetic Pharmacy Handbook, 2019. Clinical Pharmacy Working Committee (Clinical Pharmacokinetics Subspecialty) Pharmacy Practice & Development division. Ministry of Health Malaysia.
4. Injectable Drugs Dilution, 2010. Bahagian Perkhidmatan Farmasi, Jabatan Kesihatan Negeri Perak.

HRPB

HOSPITAL RAJA PERMAISURI BAINUN, IPOH

KAMI ENDAH

Kami Sedia Membantu

KEMENTERIAN KESIHATAN MALAYSIA