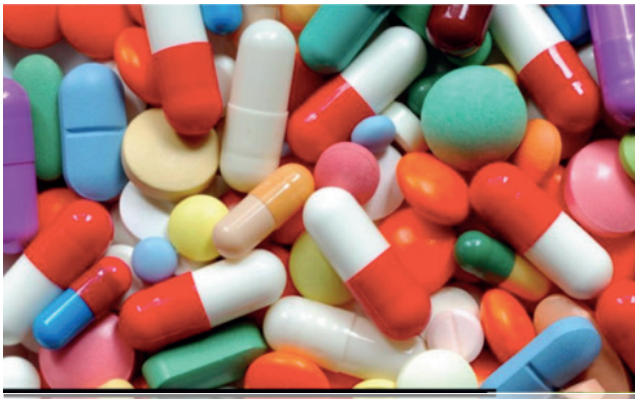
University of Nairobi

Kenyatta National Hospital

THE KNH GUIDE TO EMPIRIC ANTIMICROBIAL THERAPY

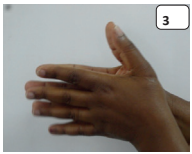


Second Edition
2018

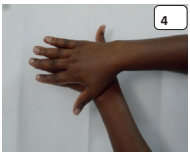
Hand Hygiene Technique

Wet hands with water water

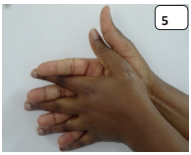
Apply enough soap to cover all hand surfaces



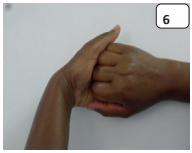
Rub hands Palm to palm



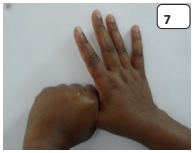
Right palm over left dorsum and left palm over right dorsum



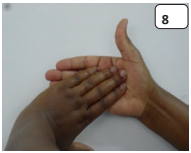
Palm to palm fingers interlaced



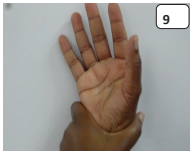
Backs of fingers to opposing palms with fingers interlocked



Rotational rubbing of right thumb clasped in left palm and vice versa

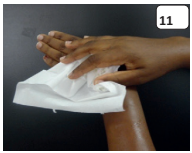


Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.



Rotational rubbing of the wrist right palm and vice

Rinse hands with water



Dry hands thoroughly with a single use towel

For hand sanitizer: put adequate amount (2-5mls) in the Palm start technique from number 3-9

Foreword

Antimicrobial stewardship programs provide coordinated strategies that promote appropriate use of antimicrobial medications to improve patient outcomes, reduce microbial resistance as well as decrease infections caused by multi-drug resistant organisms. The development of this guide was spearheaded by the KNH Antimicrobial Stewardship Committee as an important strategy in meeting this goal.

Antimicrobial resistance remains a major public health concern around the world, with the number of bacteria that are resistant to commonly used antibiotics increasing. This generally constitutes a major challenge in treatment of infections resulting in increased infection related morbidity and mortality. Hospital acquired infections, especially in critical care units, are particularly difficult to manage.

Good practice on microbiology specimen collection as well as infection control practices are key in preventing antimicrobial resistance and supporting antimicrobial stewardship strategies.

This guide seeks to promote appropriate and effective antimicrobial prescribing to enhance quality of patient care and improve clinical outcomes. We encourage all health care workers to adhere to these guidelines.

Signed

Lily Koros Tare

Chief Executive Officer

Editorial note

This guideline is an update of the previous guideline published in 2014 and has been developed by a multidisciplinary team comprising medical specialists, microbiologists, clinical pharmacists, infection prevention and control specialists and the medicine and therapeutics committee.

The hospital antibiogram has been used to identify the most common pathogens and profile their antimicrobial susceptibility patterns. The aim of this guide is to rationalise antibiotic use and optimise patient outcomes in various in-patient units.

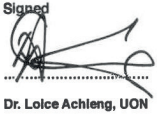
The guide does not apply to all patients uniformly. Patient care must be individualised and the choice of antimicrobials may need to be modified in special groups such as pregnant and lactating mothers, renal and hepatic dysfunction, recent antimicrobial therapy, history of hypersensitivity and the presence of significant drug interactions.

The periodic revision of this guide will be informed by changes in the local antibiogram, availability of new antimicrobials and new recommendations on antibiotic use.

This guideline should be implemented by all the relevant health care providers and where there is need for significant variation in antimicrobial choice, the Infectious Disease or antimicrobial stewardship team at the hospital should be consulted.

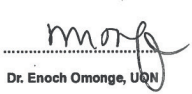
It is our intention that this guide provides a prototype upon which other antimicrobial protocols will be developed.

Signed



Dr. Loice Achieng, UON

Dr. Tom Menge, KNH



Dr. Enoch Omonge, UON

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List of abbreviations

AIDS	-	Acquired Immunodeficiency Syndrome
CCU	-	Critical Care Unit
ESBL	-	Extended Spectrum Beta Lactamase
HIV	-	Human Immunodeficiency Virus
IDS	-	Infectious Disease Specialist
IPC	-	Infection Prevention and Control
IV	-	Intravenous
KNH	-	Kenyatta National Hospital
MDR	-	Multi Drug Resistant
MRSA	-	Methicillin Resistant Staphylococcus Aureus
MSSA	-	Methicillin Sensitive Staphylococcus Aureus
PO	-	Per Oral
RIDU	-	Respiratory and Infectious Diseases Unit
SP	-	Species
TB	-	Tuberculosis
TPN	-	Total Parenteral Nutrition
UON	-	University of Nairobi

Good practice on antimicrobial use

1. Not all admitted patients require antibiotics, fever does not necessarily mean presence of a bacterial infection
2. Appropriate investigations are recommended for all infections. These are necessary for diagnosis, treatment and follow up
3. Microbiological specimens should be collected before initiating antimicrobial therapy
4. Prescribe antimicrobials contained in the hospital formulary
5. For community acquired infections in children under the age of five, use the updated *Basic Paediatric Protocols* from the Ministry of Health
6. Check for factors that will affect drug choice and dose such as age, renal and hepatic dysfunction, drug interactions, hypersensitivity reactions, pregnancy and lactation
7. Ensure that an appropriate dose is prescribed; if uncertain consult the clinical pharmacist or check in the hospital formulary
8. The need for antimicrobial therapy should be reviewed at 48 hours and regularly thereafter. If investigations do not suggest an infection, antibiotics should be stopped and other appropriate management instituted
9. For most infections 5 days of antimicrobial therapy is sufficient. Exceptions include: Meningitis, deep seated abscesses, infective endocarditis, osteomyelitis, pyelonephritis, blood stream infections secondary to MRSA and Pseudomonas
10. Once culture and sensitivity reports are available, the physician shall step down to the narrowest spectrum, most efficacious and most cost effective option
11. Prescription of a carbapenem (meropenem or imipenem) in the general wards will require approval by the ID team or clinical pharmacist
12. In case of MDR and XDR organisms, observe strict contact precautions (this will include gowns and gloves) notify IPC and consult the Infectious Disease Specialist

Good practice on microbiology sample collection

Collecting specimens for bacteriology:

1. Sterile technique should be observed. Appropriate sterile containers should be used
2. Samples should be collected at time of patient presentaton/onset of illness and before administration of any antibiotics
3. Samples should be collected only when clinically indicated. Avoid routine screening cultures

Adequate specimen collection:

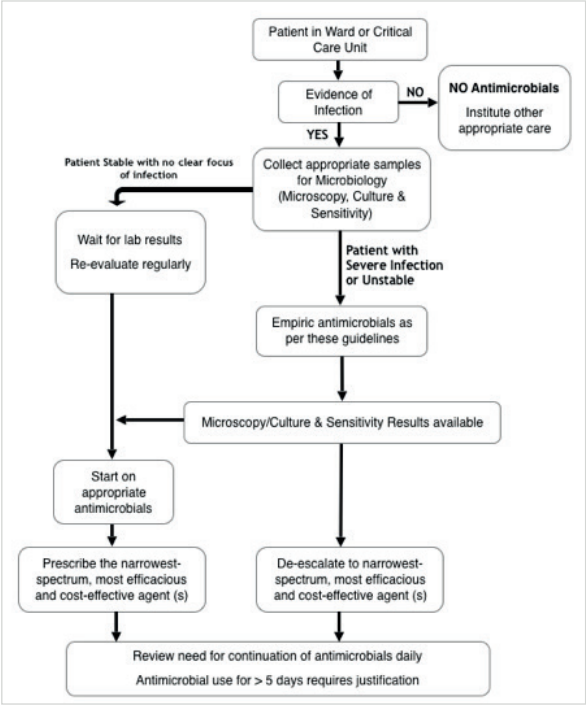
1. Blood - should be taken from 2 sites e.g. from a central line and a peripheral site or 2 peripheral sites. When taking a blood culture sample from a peripheral site, clean the site with an alcohol swab and allow 30seconds to dry before puncture, do not palpate the vessel before puncture unless sterile gloves are worn. Central venous catheter tip cultures must be accompanied by blood for culture. For adults draw 10-15ml of blood from each site, for children under 5 years, collect 1-5ml
2. Urine - should be a clean catch midstream sample, from a freshly inserted catheter or cleaned catheter hub where urine will be collected directly from the tubing. Do not collect urine from a urine bag or an indwelling catheter. Urine catheter tip cultures are not acceptable
3. Abdominal fluid - should be taken straight from the abdomen or from a newly placed drain. Do not collect specimens from existing drains
4. Wound swabs are often not useful due to contamination, to collect a swab, first clean the wound with normal saline and attempt to get a swab from the base or alternatively, get a tissue specimen for culture. Do not collect a superficial sample from the surface of a wound
5. A sterile procedure should always be used for collection of CSF, a mask should be worn to avoid respiratory contamination
6. Abscesses, bullae, blisters - aspirate directly from the abscess with a sterile needle and syringe.

Interpreting bacteriology results:

1. The clinical context must be taken into account when interpreting cultures as this will help in differentiating true infection from colonization and contamination
2. Coagulase negative staphylococci in blood will only be considered relevant if grown in more than 1 bottle in an appropriate clinical scenario (site of infection)
3. True infection is almost always present if the blood culture is positive for one of the following:
    - Streptococci (non-viridans)
    - Aerobic and facultative gram-negative rods e.g. E.coli, K.pneumoniae, Enterobacter, Pseudomonas
    - Anaerobic cocci eg peptococcus, peptostreptococcus
    - Anaerobic gram-negative rods eg Bacteroides, Prevotella, fusobacterium
    - Yeast eg candida sp
4. Suspect contamination if only one of several cultures is positive, if detection of bacterial growth is delayed (≥5 d), or if multiple organisms are isolated from one culture
5. Tracheal aspirates should only be collected if clinically indicated, consider the organism cultured as the possible cause of infection if the Chest radiograph shows infiltrates consistent with pneumonia

If you are unsure of how to interpret culture and sensitivity results, consult the Infectious Disease team (drop a consult in the ID unit or call in urgent cases)

Antibiotic prescribing algorithm (KNH)



NOTE: Use of Carbanepenems in general wards requires approval

Table 1: Infection prevention measures for invasive procedures

Central line insertion	Peripheral cannula insertion	Urinary catheter insertion
1. Perform hand hygiene 2. Put on sterile Personal Protective Equipment 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Insert the central line avoiding the femoral site 5. Secure line with sterile gauze or transparent dressing. Gauze should be changed after 48hrs and transparent dressing after 7 days or when visibly soiled. 6. Label date of insertion and document procedure. 7. Use aseptic technique while flushing the line 8. Remove central venous lines when no longer required and no longer than 2 weeks	1. Perform hand hygiene 2. Use aseptic technique 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Secure line with transparent dressing 5. Change dressing when visibly soiled 6. Use aseptic technique while flushing the line 7. Remove when no longer required	1. Perform hand hygiene 2. Use aseptic technique 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Insert catheter after applying sterile lubricating gel. Use the appropriate size catheter to minimize bladder neck and urethral trauma 5. Secure catheter to prevent movement and urethral traction. 6. Maintain a closed drainage system. 7. Drain the urine bags observing standard precautions always 8. Clean the meatal surface during daily routine bathing - don't use antiseptic baths

Patient risk stratification

Category One No contact with healthcare system in the last 90 days, no prior antibiotic treatment in the last 90 days, patient young with no co-morbidities and no organ failure.

Category Two Patient with recent hospital admission, invasive procedure and/or recent exposure to antibiotic

Category Three Patient who has had long hospitalisation with invasive procedure, recent and multiple antibiotic therapies or severe neutropenia (*consult the infectious disease team)*

Category Four Patient unresponsive to antibacterial agents consider multi drug resistant organisms or invasive candida infections (*See table 7 - This is a patient who must have an Infectious disease consult)*

How to use this guide

1. Identify the site of infection – bloodstream, intra-abdominal, lower respiratory tract (pneumonia), urinary tract and skin and soft tissue etc
2. Stratify the patient type based on described parameters – category 1, 2, 3 and 4.
3. Send specimens for cultures before initiating antimicrobial therapy.
4. Choose empiric therapy based on patient category and site of infection.
5. Empiric antibiotic therapy should be de-escalated once culture and susceptibility report is available. Where feasible, switch from intravenous to oral medication as soon as possible

Table 2: Bloodstream infections antibiotic protocol

Patient risk stratification			
	Category 1*	**Category 2**	**Category 3**
Description	No contact with health care system No prior antibiotic treatment Patient young with no co-morbidities No organ failure	Recent hospital admission, dialysis etc. without other invasive procedure Recent antibiotic therapy Patient old with co-morbidities Single organ failure	Long hospitalization With multiple Invasive procedures Recent and multiple antibiotic therapies Advanced immunodeficiency, severe Neutropenia, Multiple organ failure
Common Pathogens	*Staphylococcus aureus* , Coagulase-negative staphylococcus,*Escherichia coli*	*Escherichia coli, Klebsiella, Proteus*	*Multidrug resistant organisms including:* *Pseudomonas, Escherichia coli, Klebsiella, Enterobacter, Citrobacter* *Acinetobacter**,
Empiric **Therapy**	Coamoxiclav +/- Gentamicin or Ceftriaxone	**Preferred** Piperacillin /tazobactam + Amikacin **Alternate** Ceftazidime + Amikacin or Ertapenem	**Preferred** Full spectrum Carbapenem (Imipenem or Meropenem) + Amikacin **Alternate** Piperacillin/Tazobactam + Amikacin Cefepime + Amikacin

***** For children under 5 years, refer to the *Basic paediatric protocols*

Table 3: Pneumonia antibiotic protocol

Patient risk stratification

	Category 1	Category 2	Category 3
Description	No contact with health care system No prior antibiotic treatment Patient young with no co-morbidities	Recent hospital admission, dialysis etc. without invasive procedure Recent antibiotic therapy Patient old with co-morbidities Single organ failure	Long hospitalization With Invasive procedures Recent and multiple antibiotic therapies Advanced immunodeficiency, Neutropenia, other severe immunosuppression
Common Pathogens	**Streptococcus pneumoniae, Staphylococci spp.**	**Escherichia coli Klebsiella pneumoniae**	**Acinetobacter, Klebsiella pneumoniae, Pseudomonas spp**
Empiric Therapy	**For low severity illness, treated as out patient :** Amoxicillin or Amoxicillin /clavulanic or Cefuroxime acetyl **For patients who require admission:** Amoxycillin/clavulanic Cefuroxime or ceftriaxone + Macrolide	Piperacillin/Tazobactam or Ceftazidime **+** Amikacin	Imipenem/cilastatin or Meropenem or Piperacillin/Tazobactam or Cefepime **+** Amikacin (Vancomycin, teicoplanin or Linezolid if suspecting MRSA and consult the ID team)

1. All these patients should have a sputum for ZN stain/geneXpert to rule out tuberculosis.
2. Duration of treatment is no more than 5 days.
3. In renal dysfunction, consider a quinolone in place of an amino glycoside
4. In allergy to penicillins, use a respiratory quinolone e.g. levofloxacin

The CURB-65 scoring can be used to assess for severity of illness: score of 0-1 - low severity, 2 - moderate severity requiring ward admission, 3-4 - high severity requiring HDU/ICU admitssion.
C – Confusion (1 point), U- Urea >7mmol/l (1 point), R- Respiratory rate >30bpm (1 point), B-Blood pressure <90mmHg systolic or <60mmHg diastolic (1 point)65 - Age > 65 (1 point)

Table 4: Urinary tract infections antibiotic protocol

Patient risk stratification

	Category 1	Category 2	Category 3
Description	No contact with health care system No prior antibiotic treatment Patient young with no co-morbidities	Recent hospital admission, dialysis etc. without invasive procedure Recent antibiotic therapy Patient old with co-morbidities Single organ failure	Long hospitalization With Invasive procedures Recent and multiple antibiotic therapies Advanced immunosuppression, severe neutropenia
Common Pathogens	Escherichia coli Staph saprophyticus	Escherichia coli, Staphylococcus spp. Klebsiella, Proteus,Enterococci	Escherichia coli, Staphylococcus spp. Klebsiella, Proteus,Enterococci, Pseudomonas
Empiric Therapy	**Preferred:** Nitrofurantoin[4] **Alternate:** Cefuroxime Ciprofloxacin	Nitrofurantoin[4] or Etarpenem or Piperacillin/Tazobactam	Full spectrum carbapenem (Meropenem or Imipenem) + Amikacin or Piperacillin/ Tazobactam + Amikacin

1. Remove/change urinary catheter for all category 2 and 3 patients
2. Cystitis should be treated for 3 days in women and 7 days in men
3. Pyelonephritis should be treated for 7 days in women and 14 days in men
4. Nitrofurantoin is to be used in cystitis only. Do not use it in pyelonephritis or in urosepsis
5. Do not use nitrofurantoin in renal insufficiency

Table 5: Skin and soft tissue antibiotic protocol

Patient risk stratification			
	Category 1	**Category 2**	**Category 3**
Description	No contact with health care system No prior antibiotic treatment Patient young with no co-morbidities No organ failure	Recent hospital admission, dialysis etc. Recent antibiotic therapy Patient old with co-morbidities Single organ failure	Long hospitalization Recent and multiple antibiotic therapies Advanced immunodeficiency and Neutropenia, Multiple organ failure
Common Pathogens	Staph.aureus , streptococcus spp.	Staphylococcus spp. Enterobacteriaceae	Pseudomonas, enterobacteriaceae
Empiric Therapy	Flucloxacillin or Amoxicillin/clavulinic acid or Clindamycin or Doxycycline	Clindamycin or Cefriaxone or Tigecycline[6]	Piperacillin / Tazobactam + amikacin or Cefepime +amikacin

1.Incision & drainage and debridement remain the cornerstone of management; for chronic wounds, use antibiotics only if there are features of cellulitis and sepsis

2. Incision and drainage without antibiotics is adequate for small abscesses (<5cm)

3.Use clindamycin or add metronidazole where anaerobic infection is suspected.

4.Obtain a tissue culture for infected wounds.

5.Duration of treatment should be 5-7 days

6.Tigecycline should not to be used for diabetic foot ulcers

Table 6 : Intra-abdominal infections antibiotic protocol

Patient risk stratification			
	Category 1	**Category 2**	**Category 3**
Description	No contact with health care system No prior antibiotic treatment Patient young with no co-morbidities	Recent hospital admission, dialysis etc. without invasive procedure Recent antibiotic therapy Patient old with co-morbidities Single organ failure	Long hospitalization With Invasive procedures Recent and multiple antibiotic therapies Advanced HIV/AIDS, Neutropenia, other severe immunosuppression
Common Pathogens	**Escherichia coli, Bacteroides, Klebsiella spp, Enterococcus, Pseudomonas sp**		
Empiric Therapy	Ceftriaxone + Metronidazole or Ciprofloxacin + Metronidazole or Tigecycline + Metronidazole	Etarpenem or Piperacilin / Tazobactam + aminoglycoside or Ceftazidime + Aminoglycoside + metronidazole or Tigecycline + Metronidazole	Imipenem +/- aminoglycoside or Meropenem +/- aminoglycoside or Cefepime + Aminoglycoside + metronidazole

- Source control is key in management of complicated intra-abdominal infections
- Duration of treatment is 5 days
- With multiple abdominal surgeries consider candida infections, and consider adding azoles or echinocandins as appropriate (ID consults warranted)
- Carbapenems and piperacillin/tazobactam provide adequate anaerobic cover, do not add metronidazole or clindamycin when using these agents

Table 7 : Category four

Consider invasive candidasis in category 3 patientswith fever despite broad spectrum antibiotic therapy for more than three days with no obvious source/after appropriate source control (consult ID team) +/- sepsis/septic shock Plus ≥ one of the following risk factors to fungal infections : Hemodialysis, Central venous catheter, recent gastrointestinal surgery**,** multi focal candida colonization, diabetes mellitus/steroid use, Neutropenia/ other severe immunosuppression, mechanical ventilation and parenteral nutrition use.			
Adequate specimens of at least 30ml **MUST** be taken for blood culture.			
Empiric Therapy: **Candidaemia:** If the blood culture is positive for Candida, take repeat blood cultures every 2-3 days, continue treatment until 2 weeks after the first negative blood culture			
Pathogen	**Hemodynamically stable with no prior exposure to azoles**	**Hemodynamically stable with prior exposure to azoles**	**Hemodynamically unstable**
Candida albicans	High dose Fluconazole Refer to dosing schedule	Caspofungin or Amphotericin B (liposomal amphotericin B is preferred over deoxycholate)	Caspofungin
Non – albicans candida	Voriconazole *For C. glabrata - caspofungin	AmphotericinB or Caspofungin	Caspofungin

Cryptococcal Meningitis:

Intensive phase (2 weeks) – Amphotericin B and high dose fluconazole (1200mg)

Continuation phase (8 weeks) – Fluconazole 400mg OD

Maintenance phase (until CD4 >200) – Fluconazole 200mg

Table 8: Antibiotics for surgical prophylaxis - caesarean section

Procedure	Antibiotic	Dosage	Level of evidence
Emergency orelective caesarean section (no labour, no rupture of membranes)	Cefazolin IV 15 to60 mins prior to skin incision Penicillin allergy: Clindamycin or Erythromycin	1-2g IV 900mg IV 500mg IV	I-A
Vacuum delivery	Non recommended	N/A	II-1C
Manual removal placenta	Non recommended	N/A	III-L
Repair third or fourth degree laceration	Cefazolin/cefuroxime/cefotetan	1-2g IV	I-B
Cervical cerclage	Non recommended	N/A	II-3C
Postpartum D&C	Non recommended	N/A	No evidence
Need for broader spectrum antibiotics: • Prolonged labor (>24hrs) • Prolonged rupture of membranes (>24hrs) • Multiple number of vaginal examinations (>5 examinations) • Post partum hemorrhage (PPH) or anemia • Difficult or prolonged surgery due to adherence of placenta or numerous adhesions.	Cefazolin + Azithromycin	1-2gm IV 500mg IV	
Chorioamnionitis Treat for 5 days	Amoxicillin/clavulanic acid or Ceftriaxone + Metronidazole		

Table 9: Standard dosages of commonly used antimicrobials

Antibiotic	Doses
Amikacin	Adult and Paediatric : 15 – 20mg/kg IV daily in two divided doses Once daily dosing for all ages 15mg/kg ***Dosing interval in renal impairment*** CrCl≥ 60ml/min: Administer every 8 hours CrCl 40-60 ml/min: Administer every 24 hours CrCl 20-40 ml/min: Loading dose then monitor levels Haemodialysis: Dialyzable (50-100%) administer dose postdialysis or administer two thirds of normal dose as a supplemental dose post dialysis and follow up levels Peritoneal dialysis: Dose as CrCl<20ml/min
Amoxicillin	**Oral** Adult or Child over 10 years: 250mg every 8 hours Child upto 10 years: 20-50 mg/kg/day in 3 divided doses Doses doubled in severe infection *Otitis media (short course)* Adult :500mg every 8 hours, Child aged 3-10 years 750mg every 12 hours for 2 days *H. Pylori eradication* 1g every 112 hours for 1 week used with proton pump inhibitors and macrolide ***Dosing interval in renal impairment*** Crcr 10-50ml/min: Administer every 12 hours Clcr <10ml/min: Adminster every 24 hours Hemodialysis: Moderately dialyzable (20-50%)
Amoxicillin- Clavulinic acid	Doses calculated based on amoxicillin **Oral** Adult and Child over 12 years: 250 mg every 8 hours, doubled in severe infections Child under 1 year: 20mg/kg/day in 3 divided doses 1-6 years: 125mg every 8 hours 6-12 years: 250mg every 8 hours Severe dental infections ADULT 250mg (up to 500mg) every 8 hours for 5 days **IV injection** (administered over 3-4 minutes) ADULT and CHILD over 12 years 1 g every 8 hours increased to 1 g every 6 hours in severe infections CHILD 3 months -12 years: 30-50 mg/kg every 8 hours increased to 30-50 mg every 6 hours in more severe infections INFANT upto 3 months: 30mg/kg every 8 hours NEONATES: 30mg/kg every 12 hours ***Dosing interval in renal impairment*** Clcr 10-30 ml/min: Administer every 12 hours Clcr <10ml/min; Administer every 24 hours Haemodialysis: Moderately dialyzable (20-50%)

Azithromycin	**Uncomplicated genital chlamydia infections and trachoma,respiratory tract infections, otitis media** ADULT over 45 kg: 1 g as a single daily dose Under 45kg: 20mg/kg as a single dose As prophylaxis in Caesarian section refer to guide on table 8
Caspofungin	IV infusion ADULT 70 mg on day 1 then 50mg once daily (70mg Once daily if body weight over 80kg) Paediatric: 70mg/m2 (maximum 70 mg) on day 1 then 50mg/m2 (maximum 70mg) once daily; increased to 70 mg/m2 (maximum 70 mg) daily if lower dose tolerated but inadequate response.
Cefazolin	Administered as deep IM, IV injection or IV Infusion ADULT 1 g as a single dose at induction of anaesthesia, or after cord clamping in caeserian section, repeated if necessary if surgery lasts more than 3 hours CHILD: 25mg/kg (maximum 1 g) as a single dose at induction of anaesthesia, repeated if necessary if surgery lasts more than 3 hours Further doses may be given every 6-8 hours post operatively for 24 hours if necessary or up to 5 days in continued risk of infection.
Cefepime	Adult: 1 - 2gm IV 12hourly (up to 6gm/day in febrile neutropenia). Paediatric : 50mg/kg IV 12hourly(eight hourly in febrile neutropenia) ***Dosing in renal impairment*** ClCr 30-60 ml/min: 500mg-2g every 24 hours (2g every 12 hours in febrile neutropenia) CrCl 11-29 ml/min: 500mg-1 g every 24 hours (2g every 24 hours for febrile neutropenia) CrCl ≤10ml/min : 250-500mg every 24 hours (1g every 24 hours for febrile neutropenia) Hemodialysis: Administer 1 g on day 1 of treatment followed by 500mg dailey after hemodialysis session, for patients with febrile neutropenia 1g daily should be used
Cefotetan	ADULT Caesarian section: 1-2 g Iv given as soon as cord is clamped Cholecystitis/Intra- abdominal infection Moderate: 1-2 g IV/IM every 12 hours Severe: 2g Iv every 12 hours Life Threatening: 3 g IV every 12 hours ***Dosing in renal impairment*** CrCl 10-30 ml/min administer every 24 hours CrCl< 10ml/min administer every 48 hours
Ceftriaxone	Adult : 2g IV daily, in meningitis use 2g IV twice daily Paediatric : 20 – 50mg/kg/day IV ; up to 80mg/kg/day in severe infections No change necessary in renal impairment
Ceftazidime	Adult : 1 - 2g IV 8 to 12 hourly Paediatric : 30 – 100mg /kg/day IV in 3 to 4 divided doses ***Dosing in renal impairment*** CrCl 30-50 ml/min: Administer every 12 hours CrCl 10 ml/min: Administer every 24 hours CrCl <10ml/min: Administer every 48-72 hours Hemodialysis: Dialyzable (50-100%)

Cefuroxime	**Oral (cefuroxime axetil):** Adult: 250-500mg 12 hourly Paediatric : 20 – 30mg/kg/day in two divided doses **Intravenous (cefuroxime sodium):** Adult : 750mg - 1.5gm 6 to 8 hourly Paediatric : 20-50mg/kg/day in 3 to 4 divided doses **Dosing interval in renal impairment** CrCl 10-20 ml/min: Administer every 12 hours CrCl< 10ml/min: Administer every 24 hours Hemodialysis: Dialyzable (25%)
Ciprofloxacin	500-750mg PO 12 hourly 200mg - 400mg IV 12 hourly CHILD: 1 month-5years 4-8 mg/kg daily 5 years and above 10mg/kg daily ***Dosing in renal impairment*** CrCl 30-50ml/min: Oral 250-500mg every 12 hours CrCl 5-29ml/min: Oral 250-500mg every 18 hours, IV 200-400mg every 18-24 hours Dialysis: Only small amounts removed by dialysis: usual dose 25-500mg administered following dialysis
Clindamycin	**IM/IV infusion** ADULT: 600mg- 2700mg per day in 2-4 divided doses increased upto 4.8g daily in life threatening infections; single doses over 600mg by IV infusion only; single doses by IV Infusion not to exceed 1.2 g. Child over 1 month: 15-40mg/kg/day in 3-4 divided doses Neonates: 15-20mg/kg daily **Oral** ADULT 150-300mg every 6 hours up to 450mg every 6 hours in severe infections Pediatric 3-6 mg/kg every 6 hours
Colistin	9-12 million units stat then 3million units 8 hourly **Adjust in renal dysfunction** Note: Dosing depends on the formulation of colistin available consult clinical pharmacist when adjusting the dose.
Ertapenem	Adult and child over 13 years: 1 g IV infusion once daily Child 3months-13 years: 15mg/kg IV infusion every 12 hours (maximum 1g daily) for upto 14 days ***Dosing in renal impairment*** CrCl ≤30ml/min dose reduced to 500mg daily Hemodialysis; Adminster 150mg following hemodialysis session if patient had 500mg within 6 hours preceding the session.
Erythromycin	Adult and Paediatric : 250 – 500mg PO 6 hourly
Fluconazole	**Secondary prophylaxis for Cryptococcal Meningitis in AIDS patients after completion of primary therapy**: PO/IV infusion Adult 200mg once daily. **Systemic candidiasis**: IV infusion Adult 800mg stat then 400mg OD Paediatrics: 6-12 mg/kg/day Neonates up to 2 weeks : 6-12 mg/kg every 72 hours

	Neonates 2-4 weeks : 6-12 mg/kg every 48 hours **Cryptococcal Meningitis** (following induction with Amphotericin B): ADULT Intensive phase (2 weeks) –high dose fluconazole 1200mg OD Continuation phase (8 weeks) – Fluconazole 400mg OD Maintenance phase (until CD4 >200) – Fluconazole 200mg Paediatric Child 6-12 mg/kg/day Neonates up to 2 weeks : 6-12 mg/kg every 72 hours Neonates 2-4 weeks : 6-12 mg/kg every 48 hours **Oesophageal and oropharyngeal candidiasis**: PO/IV infusion ADULT 50-100 mg daily until symptoms resolve for 7-14 days; up to 400mg daily in very resistant infection for 14-28 days. Paediatric: 3-6mg/kg on the first day, then 3mg/kg/day (every 72 hours in neonates up to 2weeks old, every 48 hours in neonates 2-4 weeks old) **Vaginal candidiasis**: (topical preparations preferred) PO ADULT 150-200 mg as single dose ***Dosing in renal impairment*** CrCl 11-50ml/min: Administer 50% of recommended dose or administer every 48 hours Hemodialysis: One dose after each dialysis
Flucloxacillin	Adult : 250-500mg PO/IM 6 hourly; Child under 2 years 62.5mg-125mg PO/IM 6 hourly Child 2-10 years 125mg-250mg PO/IM 6 hourly OR as IV or Infusion (Slow) Adult 250mg-2g 6 hourly Child under 2 years 62.5mg-1g 6 hourly Child 2-10 years 125mg-1 g 6 hourly
Gentamicin	3 - 5mg /kg IV day as a single dose ***Dosing in renal impairment*** CrCl≥ 60ml/min : Adminster every 8 hours CrCl 40-60 ml/min: Administer every 12 hours CrCl 20-40 ml/min: Administer every 24 hours CrCl<20ml/min: Loading dose then monitor levels Hemodialysis: Dialyzable 30%;administer dose after dialysis and monitor levels

Imipenem/Cilastatin	Adult : 500mg-1gm IV 8 hourly Paediatric : Over 40kg Adult dose Over 6 kg 60mg/kg/day (maximum 2g) in 4 divided doses. Neonate under 1 week: 25-50 mg/kg every 12 hours Neonate 1-4 weeks: 25mg/kg every 8 hours 4 weeks -3 months: 25mg/kg every 6 hours ***Dosing in renal impairment*** CrCl 30-70 ml/min/1.73m^2 : Administer 500mg every 8 hours CrCl 20-30 ml/min/1.73m^2 : Administer 500mg every 12 hours CrCl 5-20 ml/min/1.73m^2 : Administer 250 mg every 12 hours Hemodialysis: Dialyzable (20-50%); administer dose post dialysis. Peritoneal dialysis dose a CrCL<10ml/min
Levofloxacin	500mg PO/IV once (or twice) daily ***Dosing in renal impairment*** Initial dose remains the same, subsequent doses adjusted based on creatinine clearance: CrCl 20-50 ml/min: Half standard dose CrCL 10-19 ml/min : After 500mg initial dose reduce to 250mg given on alternate days CrCl< 10ml/min: (Including patients in dialysis) after initial dose of 500mg reduce to 125 mg every 24 hours
Linezolid	**Oral/Intravenous:** Adult : 600mg 12 hourly (if IV – infusion over 30 – 120 minutes) Paediatric: 10mg/kg 8 to 12 hourly
Metronidazole	Adult : 800mg initially then 400mg PO 8 hourly 500mg IV 8 hourly Paediatric : 7.5mg/kg PO/IV 8 hourly **Dosing in renal impairment** CrCl < 10ml/min: Administer every 12 hours Hemodialysis : Dialyzable (50-100%), administer dose post dialysis
Meropenem	Adult : 1gm IV 8hourly Paediatric: 10 – 20mg/kg IV 8 hourly ***Dosing in renal impairment*** CrCl 26-50 ml/min Administer 1g every 12 hours CrCl 10-25 ml/min Administer 500mg every 12 hours CrCl < 10ml/min Administer 500mg every 24 hours
Nitrofurantoin	Adult : 100mg PO 6 hourly with food. Paediatric: 5 – 7mg/ kg/day PO in four divided doses. ***Dosing in renal impairment*** CrCl< 50ml/min: Avoid use
Piperacillin Tazobactam	Adult and Child over 12 years : 2.25g - 4.5gm IV 6 to 8 hourly ***Dosing in renal impairment*** CrCl 20-40 ml/min: Administer every 6 hours Crcl <20ml/min; Adminster every 8 hours

Tigecycline	>18years : initially 200mg IV, then 100mg IV 12 hourly for 5-14 days
Teicoplanin	Adult : 400mg IV 12 hourly for first 3 doses, then 400mg IV once daily Paediatric : 10mg/kg IV 12 hourly for first 3 doses, then 10mg/kg IV once daily
Vancomycin	Adult : 1gm IV 12 hourly (elderly over 65 yrs, 500mg IV 12 hourly or 1gm IV once daily) Paediatric : 10mg – 15mg/kg IV 6 to 8 hourly ***Dosing in renal impairment*** CrCl > 60ml/min: Start with 1g or 10-15mg/kg every 12 hours CrCl 40-60 ml/min: Start with 1g or 10-15 mg/kg every 24 hours CrCl <40ml/min: Longer intervals required, use serum concentration to determine the interval
Voriconazole	**Oral** **Adult over 40 kg** 400mg every 12 hours for 2 doses the 200mg every 12 hours, increased if necessary to 300mg every 12 hours. **Body weight under 40 kg** 200mg every 12 hours for 2 doses the 100mg every 12 hours, increased if necessary to 150mg every 12 hours. **Paediatric 2-12 years** (Oral suspension recommended) 200mg every 12 hours **IV Infusion** **ADULT** 6mg/kg every 12 hours for 2 doses then 4mg/kg every 12 hours (reduced to 3mg/kg every 12 hours if not tolerated) for maximum 6 months. **Pediatric 2-12 years** : 7mg/kg every 12 hours (reduced to 4mg/kg every 12 hours if not tolerated) for maximum 6 months.

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