ANTIBIOTIC GUIDELINES

Version 1.0 – 2023

Published by

Department of Health & Family Welfare
Government of West Bengal

Antibiotic Guidelines

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Preface

Antibiotics are powerful medications that have revolutionised the treatment of infectious diseases and saved countless lives. However, the misuse and overuse of antibiotics have led to the emergence of antibiotic resistance, which poses a significant threat to public health.

Antibiotic resistance is a global health crisis where bacteria become resistant to the drugs designed to kill them. Misuse and overuse of antibiotics contribute to the development of antibiotic-resistant bacteria. But in recent scenarios, Antimicrobial Resistance (AMR) is a major global health concern that threatens the effective prevention and treatment of a wide range of infectious diseases, as antimicrobial drugs become less effective, infections that were once easily treatable may become difficult or impossible to control. This can lead to longer illness durations, increased complications, and higher mortality rates.

A state-level antibiotic guideline may be an effective document to guide healthcare professionals in the appropriate and responsible use of antibiotics, ensuring their effectiveness while minimising the development of resistance. An antibiotic policy provides guidelines and protocols for healthcare professionals regarding the appropriate use of antibiotics. It emphasises the importance of prescribing antibiotics only when necessary, selecting the right drug and dose, and ensuring the proper duration of treatment. By promoting responsible antibiotic use, the policy helps to minimise the selective pressure on bacteria, reducing the likelihood of resistance development. It also helps combat Antimicrobial Resistance by discouraging inappropriate prescribing practices.

Thus, considering the importance of a proper Antibiotic guideline, a **'State Antibiotic Guidelines, Version 1.0 – 2023'** has been formulated by the State AMR Containment Monitoring & Surveillance Cell & State Level Expert Committee for AMR Containment.

All recommended therapies are either evidence-based as per universally accepted standards or based on available antibiograms at different levels of hospitals. These are general guidelines; treatment of individual patients may vary depending on local conditions and experience. The antimicrobial susceptibility data given in this guideline are available through the online portal MIARDS (Microbial Identification and Antimicrobial Resistance Detection System) and from selected tertiary care hospitals in West Bengal and do not represent community data. Antimicrobial resistance data is known to differ between different healthcare institutes and even between different wards like indoor, critical care units, etc., of the same institute.

These State-level guidelines will help institutes and treating doctors, who have no institution-specific antibiotics guideline, to implement antibiotics, mainly empirical antibiotic therapy, before receiving the culture and sensitivity reports.

Hence, each healthcare institute must customise their respective antibiotics guidelines according to their available hospital-specific antibiogram with the help of their respective Hospital Level Infection Control Committee (HICC).

State AMR Containment Monitoring & Surveillance Cell
State Level Expert Committee for AMR Containment
Department of Health & Family Welfare
Government of West Bengal

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Mamata Banerjee

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وزیراعلیٰ مغربی بنگال
CHIEF MINISTER, WEST BENGAL

14th December, 2023

MESSAGE

Antimicrobial Resistance (AMR) in disease pathogens is becoming a global public health concern. It is a need of the hour to adopt a vigilant approach to deal with this problem.

I am happy to note that the experts at Health & Family Welfare Department have prepared a State Antibiotic Guideline to deal with the problem.

I am sure that this document will be beneficial to all the stakeholders and it will improve overall patient care across the state.

(Mamata Banerjee)

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No,3 I 7-Secy (HFW)I2023

MESSAGE

Anti-microbial resistance (AMR) is a growing threat to global public health that transcends national boundaries and socioeconomic divisions. AMR affects human, animal and environmental health. With 700,000 people losing battle to antimicrobial resistance (AMR) per year and another 10 million projected to die from it by 2050, AMR alone is killing more people than cancer and road traffic accidents combined together. Economic projections suggest that by 2050, AMR would decrease gross domestic product (GDP) by 2-3.5 per cent with a fall in livestock by 3-S per cent, costing USD100 trillion to the world.

India is going to be referred to as 'the AMR capital-the world' in coming days, Our Country is striving in on one hand, with the emergence of newer multi-drug resistant (MDR) organisms which pose newer diagnostic and therapeutic challenges, and on the other hand to combat old enemies such as tuberculosis and malaria pathogens, which are becoming more and more drug resistant. Factors such as poverty, illiteracy, overcrowding, malnutrition and lack of awareness about infectious diseases in the general population and increasing tendency to purchase 'over the counter' antibiotics further compounding the situation.

Facing of this behemoth challenge of increasing multi-drug resistant (MDR) organisms in hospital environment, Department of H&FW has taken an initiative to extend a programme for hospital level containment of anti-microbial resistance in a Hub & Spoke model targeting improved microbiological diagnostic services in all Medical College Hospitals working as Hub with peripheral district and sub-district level hospital as Spoke alongwith formation of Hospital level Infection Control Committee (HIC) at all level of hospitals. Related refresher trainings in this regard have already been initiated.

Department has also launched an online portal in this regard named Microbial Identification and Anti-microbial Resistance Detection System (MIARDS) for identifying emerging antimicrobial resistance as well as determining hospital level antibiogram,

This guideline issued as part of the initiative, envisaged provision of knowledge empowerment of the health care professionals to provide high quality and sustainable health care service delivery upto the grass root level for containment of anti-microbial resistance.

20/9/2023

(Narayan Swaroop Nigam, IAS)
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MESSAGE

Antimicrobials are used frequently in human medicine, the field for which they were developed and the one with the highest,. most direct slake in their preservation. Antimicrobials are also widely used in veterinary medicine and agriculture which accounts for the largest total use of antimicrobials today. Common problems across settings contribute to misuse and overuse resulting emergence of multi drug resistance microbes due to evolution pressure and spreading the same through environmental contamination. Though it can be difficult to disentangle the relative contribution of any one type of use to the global burden of resistance, the substantial evidence indicates that the overuse and misuse of antimicrobials in both human and animal medicine drives much of the problem.

Addressing the threat of antimicrobial resistance is a fundamental global health priority, and the responsibility of all countries. Although antimicrobial drugs form an essential component of modern medicine, indiscriminate and non-judicious use of these leading to AMR which threatens the effective prevention and treatment of an increasing range of infections caused by bacteria, parasites, viruses and fungi,

An empirical diagnosis should be the one based on the best judgment of the clinician considering the patient's history and the clinical presentation and initiation of treatment with a brood-spectrum antibiotics leading to a cascade of phenomenon like somewhat indiscriminate attack on a wide range of potential pathogens, as well as disrupting commensal bacteria like gut microblome, along with supplies the selective pressure that breeds resistant descendants,

Adding this issue is the self-prescription of antimicrobial agents by the common people through over-the-counter purchase and also non-judicious and illegal use of restricted antimicrobials with erroneous close and duration of treatment without any professional knowledge.

This bock on Standard guideline regarding usage of antimicrobials in different set up and

clinical situation by incorporating diverse perspectives aims to provide a holistic and insightful knowledge to the professionals engaged in curative services. Moreover, the content of this book is structured in a user-friendly manner, ensuring easy navigation for busy healthcare professionals.

It is our sincere hope that this book becomes an indispensable resource for healthcare providers, allowing. them to deliver the highest standard for judicious use of antimicrobials for containment of anti-microbial resistance in health care set up leading to decrease in morbidity and mortality of their patients and thereby help to achieve our shared goal of improving the quality of life for the patients and the society as a whole,

Dr. Siddhartha Niyogi

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MESSAGE

Antimicrobial resistance (AMR) is a growing public health issue and needs urgent attention in countries around the world. Overuse and misuse of anti-microbial medicines are major factors that have contributed to the development of drug-resistant microbes. In many places, antibiotics are overused and misused in people and animals, and often given without professional oversight. Hospital based studies showed higher and varied spectrum of resistance in different regions while there are limited number of community based studies at country level. There exists lacunae in the structure and functioning of public health care delivery system with regard to quantification of the problem and various determining factors related to anti-microbial resistance.

The emergence and spread of AMR is further enhanced by lack of access to effective drugs, indiscriminate use of antibiotics and easy access to "over the counter" antibiotics, as well as misuse of antibiotics in veterinary use and food production, increased global travel, medical tourism and trade, and the poor application of infection control measures.

Another major cause of AMR is the release of antibiotics into the environment. This can occur as either as a result of poor manufacturing practices, the improper disposal of unused medication, human and animal excretion, and the inadequate disposal of human and animal corpses.

There is an urgent need to develop and strengthen antimicrobial policy, standard treatment guidelines, specific plan for containment of AMR and research related to public health aspects of AMR at community and hospital level in our State.

There is also a need for an effective inter sectoral co-ordination through "one health" approach to minimize unnecessary or inappropriate use of antimicrobials and to prevent and control the transmission of existing resistance. A "one health" approach recognizes that action is required across human medicine, veterinary practice and agriculture.

This antibiotic usage guideline will provide guidance to the medical personnel working at the different level of hospitals and confronting the uprising of multi drug resistant organisms in their day-to-day practices and to ensure quality and well guided activities towards containment of anti-microbial resistance in the hospital environment leading to decrease in morbidity and mortality.

The key strength of this book lies in its interdisciplinary approach involving knowledge of related domain experts towards judicious and well guided uses of common antimicrobials in different clinical situation.

Prof. (Dr.) Debasis Bhattacharyya

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Introduction

The discovery of safe and potent antimicrobial agents is one of the single greatest health care advances in history. The introduction of these antimicrobial agents significantly reduced the morbidity and mortality associated with a huge number of formerly fatal diseases. Early confidence that infections would eventually be conquered has given way to a greater appreciation of the genetic flexibility of common human pathogens. Antimicrobials have served as the corner stone of modern medicine. Beside this, the widespread use of antimicrobials has been associated with the predictable emergence of re-resistance. Emergence of antibiotic resistance is now a worldwide public health problem and a threat to mankind.

In India, the burden of infectious disease is highest among the world; and recent reports showed the inappropriate and irrational use of antimicrobial agents against the diseases led to increase in the development of antimicrobial resistance (AMR), which has emerged as a major public health problem all over the world. Infections caused by resistant microbes fail to respond to treatment, resulting in prolonged illness and greater risk of death. In India, besides poor financial conditions, inadequate infrastructure, high burden of disease, the unregulated sales of cheap antibiotics have amplified the crisis of antimicrobial resistance.

Rate of nosocomial infections range from 5% to 30% among ICU patients. The increased risk of infection is associated with severity of patient illness, length of exposure to invasive devices and associated procedures, increased patient contact with healthcare personnel, and length of stay in hospital. Over the past 15-20 years, infection control practices and new antimicrobial development have primarily targeted control and treatment of infections caused by gram-positive organisms. But, recently the incidence of infections caused by gram-negative bacteria in ICU and other indoor patients has risen, and the lack of available treatment options against some multi-drug-resistant (MDR) strains is alarming. Infections caused by MDR gram-negative organisms are also associated with high morbidity and mortality.

Treatment failures also lead to longer periods of infectivity, with increased numbers of infected people moving in the community. This in turn exposes the general population to the risk of contracting a resistant strain of micro-organisms. When these become resistant to first-line antimicrobials, the high cost of the second-line drugs may result in failure to treat these diseases in many individuals. Most alarming of all are the diseases caused by multi-drug-resistant microbes, which are virtually non-treatable and thereby create a "post-antibiotic era" scenario.

Antimicrobial Resistance (AMR) has now assumed a greater importance in our healthcare settings. The presence of compromised individuals with different co-morbid conditions in an hospital environment, which is already inhabited with a variety of infectious agents which are continuously under heavy antibiotics pressure resulting in the emergence of multi drug resistant organisms and patient congestion, poor compliances of the healthcare personnel to adhere to the simple infection prevention policies helps to spread these resistant organisms to other patients and so on in the form of cross-infection. The size of the ageing population is also on the rise, leading to an increasing number of individuals living with immune-compromised states. Such people are susceptible to spend more times in hospital environment and

act as a sitting duck to help the spreading of the organism, provide more antibiotic rich environment to produce more resistant organism exposing more patients at risk for morbidity and mortality associated with hospital acquire infections. Further, there is an association between the development of resistance in *Staphylococcus aureus, Enterococci*, and Gram-negative bacilli and an increase in mortality, length of hospitalization, and the cumulative cost of health care. This attributes to inappropriate inadequate or delayed therapy. Strategies to prevent the emergence and spread of healthcare associated antimicrobial-resistant organisms are very much essential.

An effective strategy to limit the effect of multidrug resistance must be multifaceted and must include the education of patients and healthcare personnel about the use of effective infection-control practices to prevent transmission from infected to uninfected patients, sensitisation of the physicians or surgeons regarding the usage of appropriate drugs with optimum dose and duration. Surveillance of antimicrobial resistance and antimicrobial use are also one of the most essential and effective strategy to limit the effect of multidrug resistance. The campaigns should be undertaken to educate the public about the dangers of antimicrobial resistance and sensitise them to prevent over the counter usage of antibiotics, which is also a major contributor of origin of multi drug resistance by increasing antibiotic induced genetic pressure to produce more antibiotic modulating genetic materials.

The situation on the development of new antimicrobial agents is not very much encouraging. Hardly any promising agents are in the pipeline for treatment of some common multidrug-resistant nosocomial organisms commonly grouped under the acronym ESKAPE:

- *Enterococcus faecium* (vancomycin-resistant enterococci / VRE)
- *Staphylococcus aureus* (methicillin-resistant Staphylococcus aureus / MRSA)
- *Klebsiella pneumoniae* (extended spectrum beta-lactamases (ESBL) enzymes and carbapenemase-producing)
- *Acinetobacter baumannii*
- *Pseudomonas aeruginosa*
- *Enterobacter sp.*

The solution to the current approaches to antimicrobial resistance is to preserve the effectiveness of the drugs presently available by antibiotic stewardship and to maximize hospital infection-control practices, to limit the spread of resistance.

Section I: General Consideration

Section I: General Consideration

1. Strategies

- To develop a system for rapid detection and reporting of resistant microorganisms in individual patients
- To develop a system (preferably electronics) to recognize and report trends in antimicrobial resistance within the institution.
- Ensure prompt treatment of the patient with the proper susceptible antibiotics with optimum dose, route and duration
- To incorporate the detection, prevention and control of antimicrobial resistance into institutional policies and provide the required resources.
- To assure increased adherence to basic infection control policies and procedures.
- Step-by-step approach for development and implementation of hospital antibiotic policy and standard treatment guidelines
- To establish policy and practices for rational use of antimicrobials.

2. Objectives

- Optimizing the duration of choice and dose of empiric therapy for patients with impending sepsis diagnosis in critical care units and indoor wards.
- Optimizing antimicrobial prophylaxis and operative procedures.
- Avoidance of discriminate usage of antibiotics in OPD and other patients.
- Developing and implementing an antibiotic policy and standard antibiotic usage protocol
- Monitoring and providing feedback regarding antibiotic resistance along with early detection of any evolving resistant
- Strengthening the Institution based antimicrobial stewardship.
- Improving antimicrobial prescribing by educational and administrative means.

3. Scope of hospital antibiotic policy

- The antibiotic policy is essentially for prophylaxis, empirical and definitive therapy.
- The policy shall incorporate specific recommendations for the treatment of different high-risk/special groups such as immune-compromised hosts; hospital-associated infections and community-associated infections.
- The hospital antibiotic policy shall be based upon:
  - spectrum of antibiotic activity;
  - pharmacokinetics/pharmacodynamics of these medicines;

- adverse effects;
- potential to select resistance;
- cost;
- special needs of individual patient groups.

4. Key elements of hospital antibiotic policy

- Multidisciplinary group including Microbiologists, Physicians, Surgeons, Ep-idemiologists, Nursing staffs and other para medical support staffs
- Adapting from pre-existing guideline to suit local needs
- Policy should be based on systemic review of antibiograms and surveillance data
- Recommended antibiotics should be compatible with susceptibility pattern of local pathogens
- Recommended dose, route, duration should be mentioned
- Regular auditing the process and policy outcome
- Modification of policy based on policy outcome

5. Formulation and periodic review of antibiotic policy

(a) Policy must include at least all common or prevalent infections and known causative organisms of the hospital.

(b) Policy must be formulated/ reviewed on basis of hospital's antibiogram.

(c) Policy should address use of empiric and definitive antibiotics in different sites of infections.

(d) Policy must list the restricted, limited access & under surveillance antibiotics and the mechanism to prevent inappropriate use.

(e) Antibiotic policy should give guidance on sending appropriate samples for culture, escalation and de-escalation of antibiotics mentioning right dose and right duration of antibiotic treatment along with list of antibiotics

(f) Antibiotic policy must cover the aspect of use of antimicrobials for surgical prophylaxis.

(g) The policy must be reviewed once a year and revised if required (on basis of latest antibiogram).

6. General Guidelines for usage of Antimicrobials

i. Identify the type of infection viz. bloodstream, respiratory, intra-abdominal or urinary tract

ii. Identify the origin of the sample – OPD, ICU / ITU / CCU / PICU / NICU / SNCU or other indoor wards

iii. Samples should be sent for appropriate investigations like culture & drug susceptibility testing for all the infections before starting empirical antibiotic therapy and also required

for diagnosis, prognosis and follow up of these infections.

iv. Microbiological samples, especially for blood cultures and for cultures of other samples that can be collected without compromising timing of antimicrobial administration, which has to be started within 45 minutes of admission – in case of suspected severe sepsis, must always be sent prior to initiating antimicrobial therapy. Rapid tests, such as Gram smears, can help to determine therapeutic choices when empiric therapy is required.

v. Where empiric therapy is used, the accuracy of diagnosis should be reviewed regularly and treatment altered/stopped when microbiological susceptibility results become available. Empirical therapy should be patient specific and initiation should be based on the risk potential to develop any life threatening or serious morbidity pending microbiological results.

vi. Follow the Hospital antibiotic policy when choosing antimicrobial therapy whenever possible. If alternatives are chosen, document the reason in the case records.

vii. Ensure that the appropriate dose is prescribed.

viii. Check for factors which will affect drug choice & dose, eg, renal function, drug interactions and allergy.

ix. The need for antimicrobial therapy should be reviewed on a daily basis. For most infections 5-7 days of antimicrobial therapy is sufficient (simple UTIs can be adequately treated with 3 days of antibiotic).

x. All IV antibiotics may only be given for 48 – 72 hours without review and then consideration of oral alternatives, when patient is haemodynamically stable and able to take oral medications.

xi. Promptness of the identification of the organism depending on the severity of the patient's condition

xii. Once culture reports are available, specific antimicrobial therapy should be initiated based on the narrowest spectrum, most efficacious and most cost effective option.

xiii. Antimicrobial may require being changed/de-escalated depending on changing antibiogram pattern or clinical condition of the treating patient.

- De-escalation includes stepping down the antibiotics from broad spectrum to narrow spectrum, switching over from Intravenous to oral route, and optimizing the dose and duration.
- De-escalation should be done once the culture reports are available and patient is clinically stable.
- Continued use of three or more antibiotics for more than three days should be avoided as far as practicable, based on clinical justifications and need to be documented.

xiv. Wait for at least 48hrs of antimicrobial therapy before labelling the patient as non-responding to the therapy and to switch to the next higher line of therapy. Also consider escalation if patient's condition deteriorates.

- Identify the type of infection
- Define the origin of sample
- Sample should be collected before starting antibiotics
- Proper handling of sample and transport with maintaining sterility
- Empiric antibiotic therapy, if suspected
- Justified the initiation of empiric antibiotic therapy
- Follow hospital antibiotic policy
- Ensure appropriate dose and route of administration
- Need for therapy should be reviwed daily
- Organism and its susceptibility should be identified promptly
- Specific antimicrobial therapy should be initiated based on narrowest spectrum
- Escalate or de-escalate the antibiotics based on proper clinical justification

7. Criteria for Starting Empirical Antibiotics

i. Suspicion of infection based on fever & leucocytosis – culture have to be sent.
   - if patient has temperature > 101°F or moderate leucocytosis > 15000/c mm while culture reports pending (stable hemodynamically)
   - If fever / leucocytosis is less than mentioned above, but there is a clinical suspicion of foci of infection or if patient is toxic or immunosuppressed.

ii. In unstable patient where infection process is suspected to be main or primary reason for instability.

iii. If culture / serological & other diagnostic tests prove negative and no particular focus is clinically identified, but patient is toxic, unstable. Continue antibiotics for 48 – 72 hours more & re-culture in those cases.

iv. A positive culture on a devise without a similar growth in the appropriate body fluid may represents colonization & does not warrant treatment with antibiotics.

v. In case of Surgical prophylaxis, this should only be considered, when either there is a significant risk of infection or when the consequences of infection would be disastrous (e.g. joint replacement surgery):

- **Dirty /infected wounds:** These include old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. Surgical antimicrobial prophylaxis is strongly recommended here.
- **Contaminated surgery:** Surgical antimicrobial prophylaxis is strongly recommended like bowel resection surgery, biliary or genito-urinary surgery or in case of trauma surgery due to RTA, etc
- **Clean-contaminated surgery:** Surgical antimicrobial prophylaxis is recommended where the mucosa is penetrated under controlled conditions without unusual contamination like uncomplicated appendicectomy, cholecystectomy etc
- **Clean surgery:** Surgical antimicrobial prophylaxis is only recommended for insertion of a prosthesis or artificial device or for high risk areas like CNS, eye, major vessels etc.

8. Relevant Antimicrobials

A. Antimicrobial agents used for adult patients

i. Adult Broad spectrum antibacterial agents predominantly used for Community Acquired Infection/ CAI

• Cefaclor • Cefdinir • Cefixime •Cefotaxime • Cefpodoxime • Ceftriaxone • Cefuroxime • Ciprofloxacin • Ertapenem • Levofloxacin

ii. Adult Broad spectrum antibacterial agents predominantly used for Healthcare Associated Infection/ HAI

• Amikacin (IV only) • Aztreonam (IV only) • Cefepime • Ceftazidime • Doripenem • Gentamicin (IV only) • Imipenem/ Cilastatin • Meropenem • Piperacillin/Tazobactam • Tobramycin (IV only) • Minocycline

iii. Adult Antibacterial agents predominantly used for extensively antibiotic resistant bacteria

• Ceftazidime/Avibactam • Colistin (IV only) • Polymyxin B (IV only) • Tigecycline

iv. Adult Antibacterial agents predominantly used for resistant Gram-positive infections

a) MRSA

• Ceftaroline • Daptomycin • Linezolid • Clindamycin (CA-MRSA) • Vancomycin (IV only) • Tigecycline • Teicoplanin

b) MSSA

• Cloxacillin • Cefazoline • Ceftaroline (SSTI/LRTI) • Daptomycin • Tigecycline • Teicoplanin

v. Adult Antibacterial agents posing the highest risk for CDI This category contains antimicrobials

• Cefdinir • Cefepime • Cefixime • Cefotaxime • Cefpodoxime • Ceftazidime

• Ceftriaxone • Ciprofloxacin • Clindamycin • Levofloxacin • Moxifloxacin

vi. Adult Narrow spectrum beta-lactam agents

• Amoxicillin • Amoxicillin/Clavulanate • Ampicillin • Ampicillin/Sulbactam • Cefadroxil • Cefazolin • Cephalexin • Oxacillin • Penicillin G • Penicillin V

vii. Adult Antibacterial agents posing the highest risk for CDI

• Cefdinir • Cefepime • Cefixime • Cefotaxime • Cefpodoxime • Ceftazidime • Ceftriaxone • Ciprofloxacin • Clindamycin • Gemifloxacin • Levofloxacin • Moxifloxacin

viii. Adult Antifungal agents predominantly used for invasive candidiasis

• Fluconazole • Caspofungin • Anidulafungin • Micafungin

B. Antimicrobial agents used for paediatric patients

i. Paediatric Broad spectrum antibacterial agents predominantly used for hospital-onset infections

• Amikacin (IV only) • Cefepime • Ceftazidime • Ciprofloxacin • Doripenem • Imipenem/Cilastatin • Levofloxacin • Meropenem • Piperacillin/Tazobactam • Tobramycin (IV only) • Polymyxin B • Colistin

ii. Paediatric Broad spectrum antibacterial agents predominantly used for community-acquired infections

• Amoxicillin/Clavulanate • Ampicillin/Sulbactam • Cefaclor • Cefdinir • Cefixime • Cefotaxime • Cefpodoxime • Ceftriaxone • Cefuroxime

iii. Paediatric Antibacterial agents predominantly used for resistant Gram-positive infections (e.g., MRSA)

a) MRSA

• Ceftaroline • Daptomycin • Linezolid • Clindamycin (CA-MRSA) • Vancomycin (IV only) • Tigecycline • Teicoplanin

b) MSSA

• Cloxacillin • Cefazoline • Ceftaroline (SSTI/LRTI) • Daptomycin • Tigecycline • Teicoplanin

iv. Paediatric Narrow spectrum beta-lactam agents

• Amoxicillin • Ampicillin • Cefadroxil • Cefazolin • Cefotetan • Cephalexin • Cloxacillin • Flucloxacillin • Penicillin G • Penicillin V

v. Paediatric Antibacterial agents posing the highest risk for CDI

• Cefdinir • Cefepime • Cefixime • Cefotaxime • Cefpodoxime • Ceftazidime • Ceftriaxone • Ciprofloxacin • Clindamycin • Levofloxacin • Moxifloxacin

vi. Paediatric Antibacterial agents predominantly used for extensively antibiotic resistant bacteria

• Ceftazidime/Avibactam • Ceftolozane/Tazobactam • Colistin (IV Only) • Polymyxin B (IV only) • Tigecycline • Minocycline

9. Categorization of Antibiotics

i. **Under Surveillance antibiotics: A close monitoring is required to check their usage (indication, quantity and pattern).**
   - 3rd generation cephalosporins (both oral and IV)
   - Fluoroquinolones

ii. **Limited access antibiotics:**
   Unrestricted use of these antibiotics may be allowed for empirical use for first 48-72hrs but after that a clinical justification by clinician need to be documented.
   - Imipenem/Meropenem
   - Piperacillin-Tazobactam/Cefoperazone-Sulbactam
   - Vancomycin/Teicoplanin

iii. **Restricted use antibiotics:**
   A written documentation to be maintained which captures the request along with justification foruse by the clinician.
   - Colistin: It is the last resort for managing multidrug resistant (MDR) gram negative organisms and its use, dose and duration need to be rationalised. Use should be restricted
   - Doripenem: It is the one of the last resorts carbapenem. If Imipenem andMeropenem are effective, conserve the use of Doripenem
   - Rifampicin: (For Non-TB use) This is a valuable drug for TB. The use of rifampicin in MDR Pseudomonas, Acinetobacter or MRSA should be restricted
   - Linezolid: Alternatives available eg. Vancomycin/Teicoplanin.
   - Daptomycin: Alternatives are available for MRSA eg. Vancomycin, Teicoplanin.
   - Tigecycline: one of the most Broad-spectrum drugs and has limited role in MDR infections where ESBL/MRSA and or Acinetobacter are feared.
   - Ceftazidime/Avibactam

10. Guidelines for Rational use of Antibiotics

i. Fluoroquinolones should not be started empirically except in community acquired pneumonia with strong suspicion of atypical pathogen, exclusion of the possibility of Tuberculosis and should be ruled out by sputum examination for AFB.

ii. Fluoroquinolones not to be prescribed unless cultures are not sent except in case of deep eye infection or gastroenteritis requiring antibiotics or in case of UTI.

iii. In community acquired pneumonias, send sputum culture &consider to start with

Co-amoxiclav then Azithromycin/ Clarithromycin or Doxycycline preferably.

iv. Avoid anti–pseudomonal coverage unless specifically suspected – e.g

- Ciprofloxacin among quinolones.
- Cefepime, Ceftazidime, Cefoperazone among cephalosporins.
- Amikacin among aminoglycosides.
- Piperacillin among extended spectrum penicillin.

v. Use of 3rd generation cephalosporins as empiric coverage to be avoided as far as practicable as this has potential for development of resistant bacteria in hospital.

vi. Aminoglycosides to be given as once daily dose unless given for synergy for gram positive infections or severe culture documented gram negative infection (e.g. meningitis, endocarditis)

vii. Anaerobic coverage to be carefully evaluated based on clinical situation, to avoid complication like antibiotic associated colitis & other drug related side effects.

viii. Use Amoxycillin, Co-amoxiclav, Erythromycin, Trimethoprim/ Sulfamethoxazole, second generation cephalosporines, Doxycycline or Azithromycin for commonly seen simple infections treated on outpatient basis. Always send appropriate cultures and laboratory investigations

ix. Always send urine culture before starting antibiotics for UTI due to high rate of drug resistant organisms.

x. Always send blood cultures if enteric fever is suspected or patient has temp > 101°F & present in ER.

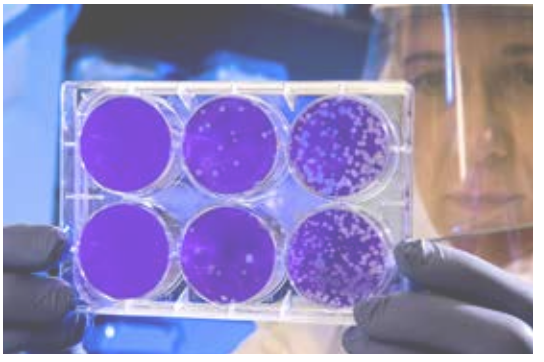
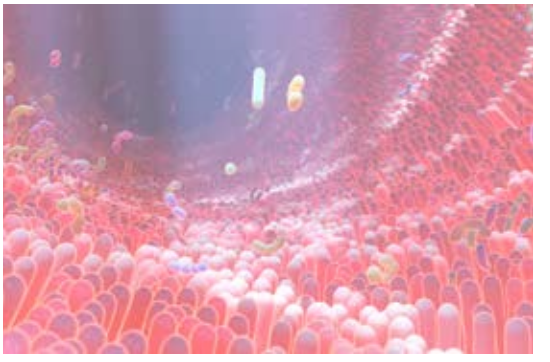
xi. List of drug resistant organisms – requiring special precaution/cohorting:

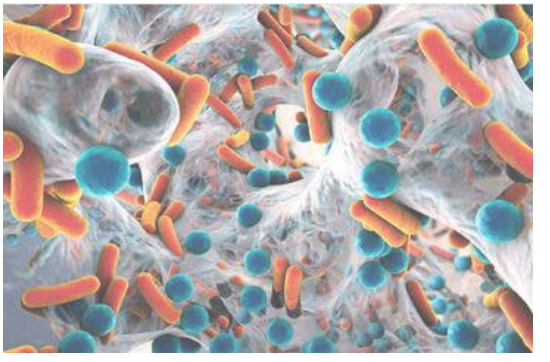
- *Acinetobacter baumannii* – any time found in culture.
- *Pseudomonas aeruginosa* & other non-fermenters – if resistance to any 2 or more of the following: Ciprofloxacin / Cefepime / Piperacillin-tazobactam / Cefoperazone-sulbactam / Carbapenems.
- *Klebsiella pneumoniae, Escherichia coli* or other Enterobacteriaceae – With resistance to 2 or more of the following: Fluoroquinolones/3rd generation cephalosporins/BL-BLI combinations or reported as ESBL producer, Amp C beta-lactamase producer/CRE
- Organisms intrinsically resistant to polymyxins like *Proteus spp, Morganella spp, Providenciaspp, Elizabethkingia meningoseptica, Stenotrophomonas malto-philia, Burkholderia cepacia, Serratia sp.*

xii. List of drug resistant organisms – requiring special precaution/cohorting and patients need isolation/ barrier nursing:

- Organisms with acquired resistance to polymyxins, like *Acinetobacter baumannii, Klebsiella pneumonia*
- *Methicillin resistant Staphylococcus aureus (MRSA)*
- *Vancomycin resistant Enterococci (VRE)*
- *Clostridium difficile colitis – diagnosed by rapid test to detect glutamate de-hydrogenase*, Toxin A, Toxin B





Section II: Antibiotic Protocol for OPD, IPD and Critical Care Settings

Section II: Antibiotic Protocol for OPD, IPD and Critical Care Settings

1. Patient Types on the Basis of Risk Factors

Patient risk factor	Patient Type 1	Patient Type 2	Patient Type 3
Hospitalization in last 90 days	No	Yes	Yes
Invasive procedures during hospitalization	Not applicable	No	Yes
Antibiotics received in last 90 day	No	≥ 2	≥ 3
Co-morbid conditions	No	≥ 2	≥ 3
Criteria to be fulfilled	All	Any 1	Any 1

- Patients with malignancy/CKD (on hemodialysis) are considered patient Type 3.
- Patient type 1 – high probability of community-acquired infections with micro organisms susceptible to classical antibiotics)
- Patient type 2 – high probability of healthcare-associated or community-acquired infections but with high probability of resistant or multidrug-resistant strains),
- Patient type 3 – maximum prediction for nosocomial infections with resistant or multi-drug-resistant strains

2. Most Common Organisms based on Stratification by Patient Risk Factors

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Bacterial infections with minimal risk of Multidrug resistant pathogens like ESBL producing Enterobacteriacae, MRSA or non-fermenters and Acinetobacter	Risk of Bacterial infections with pathogens like ESBL producing Enterobacteriacae and MRSA. Minimal risk of Non-fermenters like Pseudomonas and Acinetobacter.	High risk of Bacterial infections with any of multi drug resistant pathogens like ESBL producing Enterobacteriacae. MRSA and non-fermenters like Pseudomonas and Acinetobacter.

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Limited use of board spectrum antibacterials	ESBL infections to be treated with non-Pseudomonal antibiotics like Type 1 Carbapenem. BL + BLI's can also be preferred for mild ESBL infections. Vancomycin/Teicoplanin to be used for MRSA.	Bacterial infections to be treated with board spectrum antibiotics like Type 2. Carbapenem, Polymyxins, Ceftazidime-avibactam (CZA) + Aztreonam or Anti-Pseudomonal BL-BLI's in combination with Fluroquinolones / Aminoglycosides/ Glycopeptides.

3. Multi-Drug Resistant Bacterial Pathogens & Treatment Protocol

The resistant organism categories and their treatment protocol are listed below

a) Methicillin-Resistant Staphylococcus aureus (MRSA)

Staphylococcus aureus that has tested Resistant (R) to at least one of the following: oxacillin or cefoxitin

Treatment protocol:

i. These organisms are considered resistant to all penicillins, cephalosporins and macrolides.

ii. Though MRSA strains may be reported as susceptible to Fluoroquinolones, aminoglycosides, chloramphenicol and doxycycline in-vitro, these drugs are NOT to be used alone or as initial treatment for serious MRSA infections.

iii. Rifampicin use should be avoided in diseases other than Mycobacterial diseases.

iv. The drug of choice for treatment of infections due to MRSA is the glycopep-tides i.e Vancomycin and Teicoplanin.

v. Linezolid can be used to treat skin and soft tissue infections caused by MRSA.

vi. Mupirocin local application (intranasally bid x 5 days) for eradicating nasal carriage.

vii. Daptomycin: Daptomycin is an intravenous antibiotic approved to be used for the treatment of complicated skin infections and Staphylococcus aureus bacteraemia. Daptomycin should NOT be used for treatment of pneumonia due to its inactivation by surfactant.

b) Vancomycin Resistant Enterococcus (VRE)

Enterococcus spp. that has tested Resistant (R) to vancomycin

Treatment protocol:

The treatment for VRE should be based on infection severity and in-vitro susceptibility of

the strain to other antibiotics.

i. Linezolid: Linezolid is the only drug specifically approved for the treatment of VRE-blood stream infections

ii. Ampicillin: Isolates that remain relatively susceptible to penicillin or ampicillin may be treated with high doses of these agents

iii. Daptomycin: Not approved for treatment of VRE infection.

iv. Doxycycline: Not a first line therapy. For susceptible isolates, not for bacteremia or endocarditis. It should not be used as monotherapy.

v. Nitrofurantoin: Uncomplicated UTIs have been treated successfully with nitrofurantoin.

vi. Fosfomycin: For urinary tract infections (cystitis) with isolates susceptible to Fosfomycin.

vii. Chloramphenicol: For chloramphenicol-susceptible isolates of E faecium and E. faecalis. Not a first-line therapy and it should not be used as monotherapy.

viii. Gentamicin: To be used in combination with ampicillin for the treatment of enterococcal endocarditis caused by organisms susceptible in vitro to either agent; streptomycin is used when gentamicin cannot be used because of resistance.

ix. Tigecycline (except primary blood stream infection)

c) Extended Spectrum β-Lactamases (ESBL) Producing Enterobacteriaceae

Resistant (R) to at least one of the following: cefepime, ceftriaxone, cefotaxime, or

ceftazidime

Treatment protocol:

i. CLSI (Clinical and Laboratory Standards Institute) recommends that laboratories should report ESBL producing isolates as resistant to all penicillins, cephalosporins (including cefepime and cefpirome), and aztreonam irrespective of in-vitro test results.

ii. The carbapenems (Ertapenem, Meropenem and Imipenem) are currently considered the drug of choice for serious infections caused by these pathogens.

iii. Piperacillin–Tazobactam and Cefoperazone- Sulbactam may be considered options in mild infections and when ESBL producers are demonstrably susceptible in-vitro.

iv. The marker may be used in laboratory to assess potential ESBL production among Enterobacteriaceae is the resistance to Cefotaxime and Ceftazidime.

d) Carbapenem-Resistant Enterobacteriaceae (CRE):

Resistant (R) to at least one of the following: imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam

Treatment protocol:

i. Most carbapenemase-producers are extremely drug resistant: being resistant to β-lactam

antibiotics, aminoglycosides, and β-lactam–β-lactamase inhibitor combinations.

ii. Polymyxins, tigecycline and fosfomycin are the agents with most frequent in vitro activity, but all have limitations. Dosage will vary with the patient and infection site.

iii. Colistin: Case reports of successful use in a range of infections due to carbapenemase producers.

iv. Tigecycline: Licensed for complicated skin and soft-tissue Infections and complicated intra-abdominal infections.

v. Ceftazidime-avibactam alone if Oxa-48 producer suspected; and Ceftazidimeavibactam with Aztreonam if NDM producer suspected

vi. Others: a few isolates are susceptible to other antibiotics including e.g. chloramphenicol, ciprofloxacin and cotrimoxazole. Most producers, however, are resistant to these drugs.

e) Fluoroquinolone Resistant Enterobacteriaceae

Any *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae,* or Enterobacter spp. that has tested Resistant (R) to at least one of the following: ciprofloxacin, levofloxacin, or moxifloxacin

Treatment protocol:

i. Carbapenems like imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam

ii. Polymyxins, tigecycline & fosfomycin are the agents with most frequent in vitro activity, but all have limitations. Dosage will vary with the patient and infection site.

iii. Colistin

iv. Tigecycline: Licensed for complicated skin and soft-tissue infections and complicated intra-abdominal infections.

v. Piperacillin-tazobactam

f) Fluoroquinolone Resistant Pseudomonas aeruginosa

Pseudomonas aeruginosa that has tested Resistant (R) to at least one of the following: ciprofloxacin or levofloxacin

Treatment protocol:
i. Carbapenems like imipenem, meropenem, doripenem, ertapenem, meropenem/vaborbactam, or imipenem/relebactam

ii. Polymyxins are with most frequent in vitro activity, but dosage will vary with the patient and infection site.

iii. Ceftazidime, Ceftazidime / avibactam

iv. Colistin

v. Piperacillin-tazobactam

g) Multi-drug-resistant Pseudomonas aeruginosa

Pseudomonas aeruginosa that has tested either Intermediate (I) or Resistant (R) to at least one drug in at least three of the following six categories:

- Extended-spectrum cephalosporin (cefepime, ceftazidime, ceftazidime-avibactam, ceftolozane-tazobactam)
- Fluoroquinolones (ciprofloxacin, levofloxacin)
- Aminoglycosides (amikacin, gentamicin, tobramycin)
- Carbapenems (imipenem, meropenem, doripenem, imipenem/ relebactam)
- Piperacillin/tazobactam

Treatment protocol:

i. Carbapenems like imipenem, meropenem, doripenem, ertapenem, meropenem/

vaborbactam, or imipenem/relebactam, if found sensitive

ii. Polymyxins

iii. Colistin

4. Antibiotic Guideline in Different Types of Infections

A. Blood Stream Infections (BSIs)

i. Blood Stream Infections (BSIs) - Antibiotic Guidelines: CCU/ICU/ITU

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Ceftriaxone or Amoxicillin-Clavulanate or Ciprofloxacin*/Ofloxacin *Avoid Ciprofloxacin in patient type 1 since it has potent antipseudomonal activity.	Piperacillin-Tazobactam or Cefoperazone-Sulbactam +/- Amikacin Note: Vancomycin/ Teicoplanin to be used only in MRSA incidents is high.	Imipenem/Meropenem/ + Amikacin +/- Vancomycin/ Teicoplanin Note: Polymyxins/ Ceftazidime-avibactam (CZA) can be used empirically on Physician's discretion in very sick patients.
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
Continue empirical treatment If the pathogen is sensitive to the drug or culture is negative & patient responds to clinical treatment.	• Continue empirical treatment If the pathogen is sensitive to the drug or culture is negative & patient responds to clinical treatment. • **If ESBL +ve Enterobacteriaceae:** Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If MRSA/Enterococcus: Use Vancomycin or Teicoplanin monotherapy.	• Continue empirical treatment, if the culture is negative & patient responds to clinical treatment. • If Sensitive **Pseudomonas/ Acinetobacter** preferably a combination of Antipseudomonal betalactam + Aminoglycoside/ Anti pseudomonal FQ for 3-5 days followed by beta lactam mono-therapy for another 5-7 days. • If **MRSA/Enterococcus**: shift to Vancomycin/ Teicoplanin monotherapy.

Consider De-Escalation	Consider De-Escalation	Consider De-Escalation
If **Non ESBL Enterobacteriacae/ MSSA:** Shift to mono-therapy if combination used empirically as per the sensitivity report.	If **Non ESBL Enterobacteriaceae/MSSA:** De-Escalate & treat as patient type 1.	1. **If ESBL +ve Enterobacteriaceae:** De-escalated and treat as patient type 2. 2. **If Non ESBL/MSSA:** De-escalate and treat as patient type 1.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
• If culture negative &no clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows Pseudomonas/ Acinetobacter: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella:** Polymyxin B (PB) or Colistin/ CZA + Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter:** Colistin/ PB + High dose sulbactam +/- Carbapenem in Extended infusion. • **VRSA/VRE**: Escalate to Linezolid or Daptomycin.

ii. Blood Stream Infections (BSIs) - Antibiotic Protocol: IPD

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Oral: Cefixime or Ofloxacin or Amoxicillin-clavulanate. IV/IM: Ceftriaxone or Amoxicillin-Clavulanate or Ciprofloxacin*/ Ofloxacin *Avoid Ciprofloxacin in patient type 1 since it has potent anti-pseudomonal activity.	Piperacillin-Tazobactam or Cefoperazone-Sulbactam. Note: Vancomycin/ Teicoplanin to be used only in MRSA incidence is high.	Imipenem/Meropenem/ CZA +/- Vancomycin/ Teicoplanin.

Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteriaceae:** Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-pseudomonal drugs). • If **MRSA/Enterococcus:** Use Vancomycin or Teicoplanin monotherapy	• If the culture is negative & patient responds to clinical treatment. • If sensitive to Pseudomonas/Acinetobacter: Preferably a combination of Antipseudomonal beta-lactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by beta lactam monotherapy for another 5-7 days. • If MRSA-shift to Vancomy-cin/Teicoplanin monotherapy
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If **non ESBL Enterobacteriacae/ MSSA:** Shift to mono-therapy if combination used empirically as per the sensitivity report.	If n**on ESBL Enterobacteriaceae/MSSA:** De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae:** De-Escalate and treat as patient type 2. • If non ESBL/MSSA: De-Escalate and treat as patient type
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows Pseudomonas/Acinetobacter- treat as patient type 3.	• MDR Pseudomonas / Klebsiella: Colistin/ PB/ CZA + Antipseudomonal Beta lactam (preferably Carbapenem in Extended infusion) with maximum sensitivity. • MDR Acinetobacter: Colistin + High dose sulbactam +/- Carbapenem in Extended infusion. • VRSA/VRE: Escalate to Linezolid or Daptomycin

B. Urinary Tract Infections (UTI)

i. Urinary Tract Infections (UTI) - Antibiotic Protocol: ICU/ ITU/ CCU

Patient Type 1 (Community Acquired In-fection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before Empirical Therapy (before culture report report)**	**Empirical Therapy (before culture report)**
Ceftriaxone or Quinolones or Amikacin or Ertapenem (if community acquired ESBL producing pathogens)	Ertapenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam +/- Amikacin	Imipenem/ Meropenem or Piperacillin-Tazobactam/ Cefoperazone- sulbactam + Amikacin +/- Linezolid Note: Colistin can be used empirically on physician's discretion in very sick patients
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is suscepti-ble to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteriaceae:** Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs)	• If the culture is negative & pa-tient responds to clinical treat-ment. • If sensitive **Pseudomonas/ Acinetobacter** – use Antipseudomonal beta-lactam as per sensitivity either alone or in combination with Fluoroquino-lone or Aminoglycoside.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If **non ESBL Enterobacteri-aceae/MSSA:** Shift to mono-therapy if combination used empirically as per the sensi-tivity report.	• If **non ESBL Enterobacte-riacae/MSSA:** De-Escalate & treat as patient type 1. • If sensitive Enterococcus-A combination of Ampicillin + Gentamicin (look for synergy test) or Vancomy-cin alone.	• If **ESBL +ve Enterobacteriaceae**-De-escalate and treat as patient type 2 • If **non ESBL/MSSA**-De-escalate and treat as patient type 1 • If sensitive Enterococcus- A combination of Ampicillin + Gentamicin (look for synergy test) or Vancomycin alone.

Consider Escalation	Consider Escalation	Consider Escalation
1. If culture negative & no clinical response within 48 hours of treatment. 2. If culture is ESBL positive, treat as patient type 2	1. If culture negative & no clinical response within 48 hours of treatment. 2. If culture shows Pseudomo-nas/ Acinetobacter- Treat as patient type 3	1. **MDR Pseudomonas/ Klebsiella:** Colistin/ PB/ CZA + Aztreonam/Antipseudomonal Beta lactam, (preferably Carbapenem in Extended infusion) with maximum sensitivity. 2. MDR Acinetobacter: Colistin/ PB + High dose Sulbactam +/- Car-bapenem in Extended infusion.

ii. Urinary Tract Infections (UTI) - Antibiotic Protocol: IPD

Patient Type 1 (Community Acquired In-fection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Oral: Norfloxacin or Ce-furoxime/Cefixime or Amoxicillin-clavulanate or Nitrofurantoin or Trimethoprim + Sulfamethoxazole (if community acquired ESBL cystitis) or Fosfomycin single dose IV/IM: Ceftriaxone/Ofloxacin or Amikacin/Ertapenem (If community acquired ESBL UTI).	Ertapenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam	Imipenem/ Meropenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam +/- Amikacin Note: Colistin can be used empirically on physician's discretion in very sick patients.
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteri-aceae:** Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If **MRSA/Enterococcus**: Use Vancomycin or Teicoplanin monotherapy.	• If the culture is negative & patient responds to clinical treat-ment. • If sensitive **Pseudomonas/ Acinetobacter** – use Antipseudomonal beta-lactam as per sensitivity either alone or in combination with Fluoroquinolone or Aminoglycoside.

Consider De-Escalation	Consider De-Escalation	Consider De-Escalation
If non **ESBL Eneterobteriacae/MSSA:** Shift to monotherapy if combination used empirically as per the sensitivity report.	• If **non ESBL Enterobacteriacae/MSSA**: De-Escalate & treat as patient type 1. • If sensitive Enterococcus- A combination of Ampicillin + Gentamicin (look for synergy test) or Vancomycin alone.	• If **ESBL +ve Enterobacteriaceae**- Deescalate and treat as patient type 2 • If **non ESBL/MSSA**- De-escalate and treat as patient type 1 • If sensitive **Enterococcus**- A combination of Ampicillin + Gentamicin (look for synergy test) or Vancomycin alone.
• If culture negative & no clinical response within 48 hours of treatment. • If culture is **ESBL** posi-tive, treat as patient type 2	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows **Pseudomonas/ Acinetobacter** - Treat as patient type 3	• **MDR Pseudomonas/ Klebsiella:** Colistin/ CZA + Aztreonam/ Antipseudomonal Beta lactam Preferably Carbapenem in Ex-tended infusion) with maxi-mum sensitivity. • **MDR Acinetobacter**: Colistin + High dose Sulbactam +/- Carbapenem in Extended infusion.

C. Respiratory Tract Infections (RTI)

i. Respiratory Tract Infections - Antibiotic Protocol: ICU/ITU/CCU

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated In-fection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Ceftriaxone/Amoxicillin-Clavulanate +/- Clarithro-mycin/ Azithromycin or respiratory Fluoroquino-lone (eg. Gemifloxacin, Moxifloxacin).	Piperacillin-Tazobactam/ Cefoperazone-Sulbactam +/- Ciprofloxacin/Amikacin/ Doxycycline.	Imipenem/ Meropenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Amikacin/ Levofloxacin/ Doxycycline / Minocycline &/or Linezolid/ Teicoplanin/ Vancomycin. Note: Colistin/ PB/ CZA can be used empirically on physician's discretion in very sick patients.

Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirical-ly or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If ESBL +ve Enterobacte-riaceae: Continue treat-ment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If MRSA/Enterococcus: Use Vancomycin or Teicoplanin monotherapy.	• If the culture is negative & patient responds to clinical treatment. • If Sensitive **Pseudomonas/ Acinetobacter** preferably a combination of Antipseu-domonal beta-lactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days fol-lowed by beta lactam mono-therapy for another 5-7 days. • If **MRSA** shift to Vancomycin or Teicoplanin monotherapy.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If Non ESBL Enterobacte-riacae/MSSA: Shift to monotherapy if combination used empirically as per the sensitivity report.	If Non ESBL Enterobacteri-aceae/MSSA: De-Escalate & treat as patient type 1.	• If **ESBL** +ve Enterobacteri-aceae: De-escalate and treat as patient type 2. • If **Non ESBL/MSSA**: De-escalate and treat as patient type 1.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows Pseudomonas/ Acinetobacter: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella**: Colistin/ PB/ CZA + Aztreonam/ Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Colistin + High dose sulbactam +/- Carbapenem in Extended infusion or Minocycline or Tigecycline . • **VRSA/VRE**: Escalate to Linezolid or Daptomycin (only in SST).

ii. Respiratory Tract Infections - Antibiotic Protocol: IPD

Patient Type 1 (Community Acquired In-fection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Oral: Amoxicillin-Clavulanate or Cefpodox-ime/Cefdinir +/- Macrolide (Clarithromycin/ Azithromycin) or Respiratory Fluoroquinolone (eg. Gemifloxacin, Moxi-floxacin) IV/IM: Ceftriaxone or Amoxicillin-Clavulanate +/-Macrolide.	Piperacillin-Tazobactam/ Cefoperazone-Sulbactam +/- Amikacin/Ciprofloxacin/ Doxycycline Note: Vancomycin/ Teicoplanin to be used on-ly if MRSA incidence is very high. Macrolide can be added in RTI.	Imipenem/ Meropenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Linezolid/ Teicoplanin/ Vanco-mycin +/- Amikacin/Levofloxacin/ Doxycycline/ Minocycline.
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteriaceae**: Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If **MRSA/Enterococcus**: Use Vancomycin or Teicoplanin monother-apy.	• If the culture is negative & patient responds to clinical treatment. • If Sensitive **Pseudomonas/ Acinetobacter** preferably a combination of Antipseudomonal beta-lactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by beta lactam monotherapy for another 5-7 days. • If **MRSA** shift to Vancomycin/ Teicoplan inmonotherapy.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
If **Non ESBL Enterobacteriacae/MSSA**: Shift to mon-otherapy if combination used empirically as per the sensitivity report.	If **Non ESBL Enterobacteriaceae/MSSA**: De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae**: De-escalate and treat as patient type 2. • If Non ESBL/MSSA: De-escalate and treat as patient type 1.

Consider De-Escalation	Consider De-Escalation	Consider De-Escalation
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows Pseudomonas/ Acinetobacter: Treat as Patient type	• **MDR Pseudomonas/ Klebsiella**: Colistin/ PB/ CZA +Aztreonam/ Antipseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Colistin + High dose sulbactam +/- Carbapenem in Extended infusion or Tigecycline. • **VRSA/VRE**: Escalate to Line-zolid.

D. Skin & Soft Tissue infections

i. Skin & Soft Tissue infections- Antibiotic Guidelines: ICU/ITU/CCU

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Cefuroxime/Cloxacillin/ Ciprofloxacin* + Metronidazole or Clindamycin or Amoxicillin-Clavulanate alone. *Avoid ciprofloxacin in Patient type 1 since it has potent anti-pseudomonal activity. Note: Source control is must in SSTIs.	Ertapenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Amikacin Note:Vancomycin/ Teicoplanin to be used only in MRSA incidence is high.	Imipenem/ Meropenem or Tigecycline or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Amikacin/ Levofloxacin. Note: Colistin can be used empirically on physician's discretion in very sick patients.

Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteriaceae**: Continue treatment with monotherapy as per sensitivity report (Avoid using broad spec-trum anti-Pseudomonal drugs) • If **MRSA/Enterococcus**: Use Vancomycin or Teicoplanin monotherapy.	• If the culture is negative & patient responds to clinical treatment. • If culture shows **Pseudomonas/ Acinetobacter:** preferably a combination of Antipseudomonal betalactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by beta lactam monotherapy for another 5-7 days. • If **MRSA** shift to Vancomycin/ Teicoplanin monotherapy.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If Non ESBL Enterobacteriacae/MSSA: Shift to monotherapy if combination used empirically as per the sensitivity report.	If Non ESBL Enterobacteriaceae/MSSA: De-Escalate & treat as patient type 1.	. If ESBL +ve Enterobacteriaceae: De-escalated and treat as patient type 2. 2. If Non ESBL/MSSA: De-escalate and treat as patient type 1.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows **Pseudomonas/ Acinetobacter**: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella**: Colistin/ PB/ CZA + Aztreonam/ Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Col-istin + High dose sulbactam +/- Carbapenem in Extended infusion or Tigecycline. • **VRSA/VRE**: Escalate to Linezolid or Daptomycin (only in SST).

ii. Skin & Soft Tissue infections Antibiotic Protocol: IPD

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Amoxycillin-Clavulanate or Cefuroxime/ Cefadroxil +/- Metronidazole/ Clindamycin. *Avoid ciprofloxacin in patient type 1 since it has potent antipseudomonal activity. Note: Source control is must in SSTIs.	Ertapenem/Piperacillin-Tazobactam/ Cefoperazone-Sulbactam +/- Amikacin/ Ciprofloxacin Note: Vancomycin/ Teicoplanin to be used only if MRSA incidence is very high. Macrolide can be added in RTI.	Imipenem/Meropenem or Tigecycline or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Linezolid/ Teicoplanin/ Vancomycin +/- Amikacin/ Levofloxacin.
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If ESBL +ve Enterobacteriaceae: Continue treatment with mono-therapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If MRSA/Enterococcus: Use Vancomycin or Teicoplanin monotherapy	• If the culture is negative & patient responds to clinical treatment. • If Sensitive Pseudomonas/ Acinetobacter preferably a combination of Antipseudomonal betalactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by beta lactam monotherapy for another 5-7 days. • If MRSA shift to Vancomycin/ Teicoplaninmonotherapy.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If **Non ESBL Enterobacteriacae/MSSA**: Shift to monotherapy if combination used empirically as per the sensitivity report.	If **Non ESBL Enterobacteriaceae/MSSA**: De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae**: De-escalate and treat as patient type 2. • If **Non ESBL/MSSA**: De-escalate and treat as patient type 1.

Consider De-Escalation	Consider De-Escalation	Consider De-Escalation
If **Non ESBL Enterobacteriacae/MSSA**: Shift to monotherapy if combination used empirically as per the sensitivity report.	If **Non ESBL Enterobacteriaceae/MSSA**: De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae**: De-escalate and treat as patient type 2. • If Non ESBL/MSSA: De-escalate and treat as patient type 1.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows **Pseudomonas/ Acinetobacter**: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella**: Colistin/PB/ CZA + Aztreonam/ Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Colistin + High dose sulbactam +/- Carbapenem in Extended infusion or Tigecycline. • **VRSA/VRE**: Escalate to Linezolid or Daptomycin (only in SST).

E. Intra-abdominal infections

i. Intra-abdominal infections Antibiotic Protocol: ICU/ITU/CCU

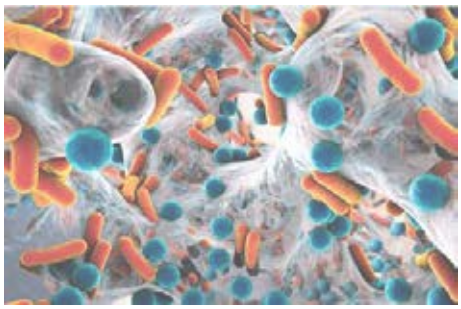
Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Metronidazole or Clindamycin.	Ertapenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Metronidazole or Clindamycin	Imipenem/ Meropenem or Tigecycline or Piperacillin-Tazobactam/Cefoperazone-Sulbactam + Metronidazole or Clindamycin. Note: Colistin can be used empirically on physician's discretion in very sick patients.

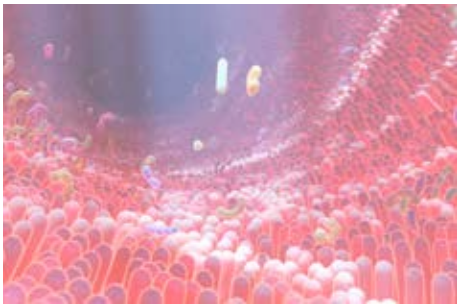
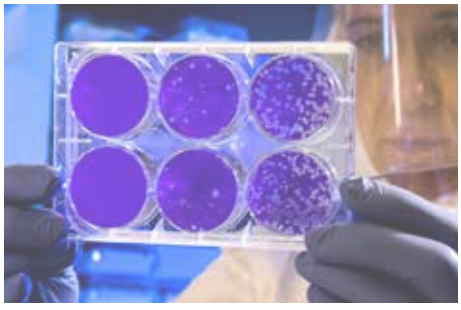
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL +ve Enterobacteriaceae**: Continue treatment with mono-therapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If **MRSA/Enterococcus**: Use Vancomycin or Teicoplanin Monotherapy.	• If the culture is negative & patient responds to clinical treatment. • If culture shows **Pseudomonas/ Acinetobacter**: preferably a combination of Antipseudomonal betalactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by betalactam monotherapy for another 5-7 days • If **MRSA** detected - shift to Vancomycin/ Teicoplanin monotherapy.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If Non **ESBL Enterobacteriacae/MSSA**: Shift to monotherapy if combination used empirically as per the sensitivity report	If **Non ESBL Enterobacteriaceae/MSSA**: De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae**: De-escalated and treat as patient type 2. • If **Non ESBL/MSSA**: De-escalate and treat as patient type 1.
Consider Escalation	**Consider Escalation**	**Consider Escalation**
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows **Pseudomonas/ Acinetobacter**: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella**: Colistin/ PB/ CZA + Aztreonam/ Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Colistin + High dose sulbactam +/- Carbapenem in Extended infusion or Tigecycline. • **VRSA/VRE**: Escalate to Linezolid or Daptomycin (only in SST).

ii. Intra abdominal infections Antibiotic Protocol: IPD

Patient Type 1 (Community Acquired Infection/ CAI)	Patient Type 2 (Healthcare Associated Infection/ HAI)	Patient Type 3 (Nosocomial Infection/ NI)
Empirical Therapy (before culture report)	**Empirical Therapy (before culture report)**	**Empirical Therapy (before culture report)**
Ceftriaxone + Metronidazole or Clindamycin.	Ertapenem or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Metronidazole or Clindamycin	Imipenem/ Meropenem or Tigecycline or Piperacillin-Tazobactam/ Cefoperazone-Sulbactam + Metronidazole or Clindamycin. Note: Colistin can be used empirically on physician's discretion in very sick patients
Continue Treatment (after culture report)	**Continue Treatment (after culture report)**	**Continue Treatment (after culture report)**
If the pathogen is sensitive to the drug used empirically or culture is negative & patient responds to clinical treatment.	• If the pathogen is susceptible to the drug used empirically or culture is negative & patient responds to clinical treatment. • If **ESBL** +ve Enterobacteriaceae: Continue treatment with monotherapy as per sensitivity report (Avoid using broad spectrum anti-Pseudomonal drugs) • If **MRSA/Enterococcus**: Use Vancomycin or Teicoplanin monotherapy.	• If the culture is negative & patient responds to clinical treatment. • If Sensitive **Pseudomonas/ Acinetobacter** preferably a combination of Antipseudomonal betalactam + Aminoglycoside/ Antipseudomonal FQ for 3-5 days followed by betalactam monotherapy for another 5-7 days • If **MRSA** shift to Vancomycin/ Teicoplanin monotherapy.
Consider De-Escalation	**Consider De-Escalation**	**Consider De-Escalation**
If **Non ESBL Enterobacteriacae/MSSA**: Shift to monotherapy if combination used empirically as per the sensitivity report	If **Non ESBL Enterobacteriaceae/MSSA**: De-Escalate & treat as patient type 1.	• If **ESBL +ve Enterobacteriaceae**: De-escalate and treat as patient type 2. • If **Non ESBL/MSSA**: De-escalate and treat as patient type 1.

Consider Escalation	Consider Escalation	Consider Escalation
• If culture negative & clinical response within 48 hours of treatment. • If culture is ESBL positive, treat as patient type 2.	• If culture negative & no clinical response within 48 hours of treatment. • If culture shows **Pseudomonas / Acinetobacter**: Treat as Patient type 3.	• **MDR Pseudomonas/ Klebsiella**: Colistin/PB/ CZA + Aztreonam/ Anti-pseudomonal Beta lactam (pref. Carbapenem in Extended infusion) with maximum sensitivity. • **MDR Acinetobacter**: Colistin + High dose sulbactam +/- Car-bapenem in Extended infusion or Tigecycline. • **VRSA/VRE**: Escalate to Linezolid or Daptomycin (only in SST).




Section III: Surgical Prophylaxis

Section III: Surgical Prophylaxis

1. Introduction

Preoperative antibiotic prophylaxis is administering antibiotics before performing surgery to help decrease the risk of postoperative infections. The evidence supporting routine preoperative use of prophylactic antibiotic administration continues to grow. The routine administration of prophylactic antibiotics is standard in cases in which a patient will have an artificial implant or foreign body implanted as part of the procedure, bone grafting procedures, and other surgeries with extensive dissections and expectations for higher amounts of anticipated blood loss. This activity will highlight the rationale, timing, agent selection, coverage, and monitoring pertinent for inter-professional team members involved in the administration of preoperative antibiotic prophylaxis to patients.

Antimicrobials used for surgical prophylaxis should have no adverse consequences for the microbial flora of the patient or the hospital, and produce no adverse effects. The chosen drug must be active against the pathogen that is most likely to contaminate the wound. The prophylactic antimicrobial must be given at an appropriate dosage and at an appropriate time to ensure adequate concentration at the incision site during the period of potential contamination. It should be administered for the shortest effective period to minimize adverse effects, development of resistance and cost. Antibiotic use for dirty and contaminated procedures is not classified as prophylaxis, but considered as a therapeutic treatment for presumed infection (i.e. non prophylactic use). Prophylactic antimicrobial agents should not be the same as those used for treatment.

2. Goal

Administer antimicrobial prophylaxis to achieve serum and tissue levels of antimicrobial at the time of incision and for the duration of the operation, that are in excess of the minimum inhibitory concentration (MIC) needed for organisms that may be encountered during the procedure.

The key elements of appropriate surgical antimicrobial prophylaxis prescribing include the correct indication, antimicrobial, drug dose, route, timing of administration and duration.

- Right indication.
- Right antimicrobial.
- Right dose.
- Right route of administration.
- Right timing of administration.
- Right duration.

3. Classification of Operative Wounds and Risk of Infection with or without Prophylaxis

Classification	Criteria	Infection risk(%) with prophylaxis	Infection risk (%) without prophylaxis
Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered	1-2	1-2
Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g., appendectomy) not encountering infected urine or bile; minor technique break	3	6-9
Contaminated	Non-purulent inflammation; gross spillage from gastrointestinal tract; entry into biliary or genitourinary tract in the presence of infected bile or urine; major break in technique; penetrating trauma < 4 hours old; chronic open wounds to be grafted or covered	6	13-20
Dirty	Purulent inflammation (e.g., abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma > 4 hours old	7	~ 40

4. Principles of Surgical Prophylaxis

i. Antimicrobial prophylaxis should be administered if there is a risk of infection in the absence of a prophylactic agent; clean procedures rarely require prophylaxis unless high risk procedure, including implantation of prosthetic material.

ii. Clean procedures are defined as those with no acute inflammation or transection of gastrointestinal, oropharyngeal, genitourinary, biliary or respiratory tracts (elective cases, no technique break).

iii. Standard antimicrobial therapy is indicated for Contaminated Wounds and Dirty or Infected Wounds. Surgical prophylaxis is indicated for clean and clean-contaminated procedures; administration of post-operative antibiotic doses is not recommended in clean and clean-contaminated procedures.

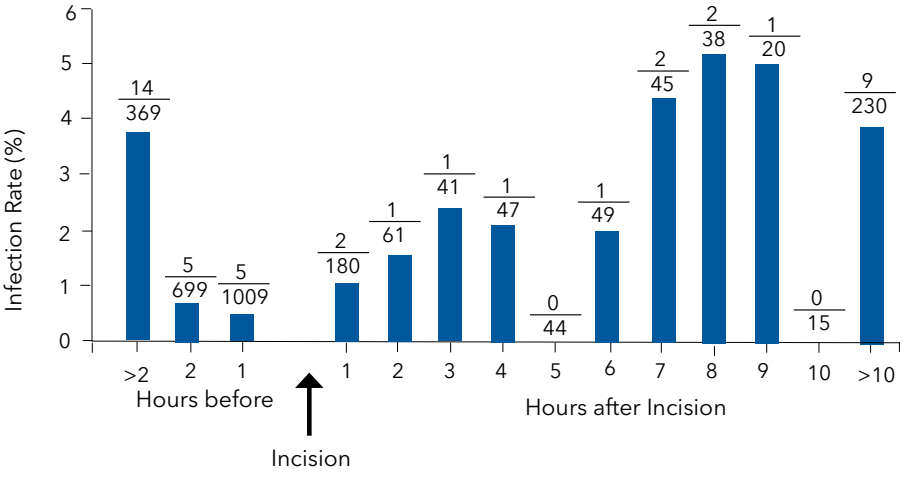
iv. Documentation of antimicrobial administration must include date, time of administration, name of medication, dose, and route of administration.

v. The activity of the chosen prophylactic agent(s) should encompass the most common pathogens associated with the surgical procedure and consider local susceptibility data, but need not cover every likely pathogen.

vi. The prophylactic agent must be administered in a dose which provides an effective tissue concentration prior to incision / intra-operative bacterial contamination.

vii. In most instances, a single intravenous dose of an antimicrobial agent provides adequate tissue concentrations around the time of anaesthesia induction and throughout the operation.

TIMING OF ADMINISTRATION has been based on multiple evidences amongst which a landmark article is shown to highlight the temporal association of time of administration of Antibiotic with Surgical site infection.



Rates of surgical wound infection corresponding to the temporal relation between antibiotic administration and the start of surgery

The number of infections and the number of patients for each hourly interval appear as the numerator and denominator, respectively, of the fraction for that interval. The trend towards higher rates of infection for each hour that antibiotic administration was delayed after the surgical incision was significant.

viii. Intra-operative re-dosing is necessary during procedures that exceed two half-lives of the drug to maintain adequate serum and tissue concentrations.

- Coverage must be provided from time of incision to closure of incision.
- Re-administer is recommended for prolonged surgery (more than 4 hours from the time of first preoperative dose) when a short-acting agent is used (e.g. cefazolin dose should be repeated after 4 hours).
- Re-administer if excessive bleeding (Blood loss>1,500ml for adult patient) or change in half-life of drug (i.e. extensive burns).
- May avoid re-administration if half-life is extended (e.g. renal insufficiency).

ix. Antimicrobial agent infusion should begin 15-60 minutes before the incision with the exception of vancomycin, levofloxacin, ciprofloxacin, gentamicin, azithromycin and fluconazole. These infusions should begin 45-90 minutes before the incision and infused over 60-120 minutes as indicated for adults and paediatrics.

x. All prophylactic antimicrobials should be discontinued after the intra-operative period, unless otherwise specified.

xi. A longer duration of antimicrobials may be indicated, if concomitant infection is present at the time of surgery – Not exceeding 48 hrs after surgery

xii. If a tourniquet is to be used in the procedure, the entire dose of antibiotic must be infused prior to tourniquet inflation.

xiii. In clean and clean contaminated procedures, high-quality evidence suggests that additional prophylactic antibiotic doses are not needed after the surgical incision is closed in the OR even in the presence of a drain.

xiv. For all other procedures, antibiotic prophylaxis must be discontinued within 24 hours of surgical end time.

- Data have not supported subsequent doses after surgical closure and may increase the risk of Clostridium difficile and antimicrobial resistance.
- Use of antibiotics beyond the recommended post-operative duration requires proper documentation of infection or suspected infection.
- Vancomycin use requires documentation of the reason for use in the medical record by the prescribing physician. Reasons for use include:
  - Betalactam (penicillin or cephalosporin) allergy
  - Known Methicillin resistant Staphylococcus aureus (MRSA) colonization or infection or high risk for MRSA (i.e. recent inpatient hospitalization, resides in an extended care facility, receives dialysis)

xv. Timing

- Recommended timing is 15 minutes to 120 minutes prior to incision time to ensure adequate concentration of antimicrobial at the incision site.

- All Surgical Prophylaxis Antimicrobials except for Metronidazole and Vancomycin should be administered via intravenous injection over a period of 2-3 minutes.
- Metronidazole and Vancomycin Infusion should be completed 30 minutes before surgical incision time.
- IV cefazolin can be given over 5 minutes and should be administered no more than 60 minutes before skin incision.
- IV gentamicin can be given over 3 to 5 minutes and should be administered within 120 minutes before surgical incision.
- IV metronidazole infusion can be given over 20 minutes and should be fully administered within 120 minutes of surgical incision. Maximum plasma and tissue concentrations occur at the conclusion of the infusion.
- IV vancomycin infusion should be given at a rate of 1g over at least 60 minutes and 1.5g over at least 90 minutes. Vancomycin should be timed to begin 15 to 120 minutes before skin incision. This ensures adequate concentration at the time of incision and allows for any potential infusion related toxicity to be recognised before induction. The infusion can be completed after skin incision.

xvi. Antibiotics not recommended for Surgical Prophylaxis:

- Fourth generation cephalosporins: e.g. Cefepime, Cefpirome
- Fluoroquinolones
- Carbapenems
- Polymyxins
- Fosfomycin
- Tetracyclines & Tigecycline
- Daptomycin

xvii. Antibiotics that may be allowed for surgical Prophylaxis with special considerations & in special circumstances:

- Third generation cephalosporins.
- Beta-lactam – Beta-lactamase inhibitor combination.
- Linezolid

xviii. Fluconazole prophylaxis is reserved for patients with two or more of the following risk factors: Need for re-operation, Re-transplantation, Renal failure, Choledocho-jejunostomy and known colonization with Candida species. Other azoles, Amphotericin B and Echinocandins are not recommended for surgical prophylaxis.

5. Pathogen-Specific antimicrobial therapy according to the pathogen isolated

Surgical wound classification	Common organisms	Antimicrobial prophylaxis
Class I / Clean	Gram Positive cocci (S. aureus, CoNS)	None or single perioperative dose of cefuroxime/ cephalexin (Ideally 2 grams)
Class II / Clean-contaminated	Gram Negative Bacilli Anaerobes S. aureus	**1st Line:** Cefazolin or Ampicillin-sulbactam or Ceftriaxone (in patients of acute cholecystitis or acute biliary tract infections) **Alternative:** In case of allergies; if mixture of GP and GN is suspected: Ceftriaxone (only if not ESBL), clindamycin or vancomycin with cefazolin, aztreonam, gentamicin, or single-dose fluoroquinolone in Beta-lactam allergy
Class III / Contaminated	Gram Negative Bacilli Anaerobes	**1st line:** Cefazolin+ Metronidazole **2nd Line:** Metronidazole+ Aminoglycoside/ Fluoroquinolone
Class IV / Dirty	Gram Negative Bacilli Anaerobes May be mixed with Gram positive bacteria	**1st Line:** Cefazolin+metronidazole, **Treatment for infected surgical wounds**: Ertapenem + Clindamycin + aminoglycoside/aztreonam Or fluoroquinolone+ metronidazole + aminoglycoside/ fluoroquinolone

6. Recommended Prophylactic Antimicrobials

A. Abdominal, Gastrointestinal, & Billiary Surgery

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin allergy
• **Appendicectomy (including laparoscopic procedures), exploratory laparotomy, division of adhesions, resection**	Cefazolin1g IV PLUS Metronidazole 500mg IV infusion Or Inj. Cefoperazone-Sulbactam 2gm IV stat & BD for 24hrs (maximum) High risk of MRSA infection: ADD vancomycin 1g IV infusion	Gentamicin 2mg/kg IV PLUS Metronidazole 500 mg IV infusion High risk of MRSA infection: ADD Vancomycin1g IV infusion
• **Gastroduodenal and oesophageal Non-endoscopic procedures that enter the GI tract lumen**	Cefazolin1g IV Or Inj. Cefoperazone-Sulbactam 2 gm IV stat & BD for 24hrs (maximum) High risk of MRSA infection: ADD Vancomycin1g IV infusion	Gentamicin 2mg/kg IV PLUS Vancomycin1g IV infusion
• **Small intestinal** • **(Non-obstructed)**	Cefazolin 1 g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs. High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Clindamycin 900 mg + Gentamicin 5 mg/kg High risk of MRSA infection: ADD Vancomycin 1g IV infusion
• **Small intestinal** • **(Obstructed)**	Cefazolin1g IV Or Inj. Cefoperazone - Sulbactam 2gm IV stat & BD for 24hrs (maximum) If the small intestine is obstructed: ADD Metronidazole 500mg IV infusion/ Piperacillin-tazobactam (4.5 gm) High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Gentamicin 2mg/kg IV PLUS Metronidazole 500 mg IV infusion High risk of MRSA infection: ADD Vancomycin 1g IV infusion

• **Colorectal:** • **Non-endoscopic colorectal proceduress (e.g. colon resection, revision of anastomosis)**	Cefazolin 2g IV PLUS Metronidazole 500mg IV infusion/ Piperacillin-tazobactam (4.5 gm) High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV infusion OR Clindamycin 900 mg + Gentamicin 5 mg/kg High risk of MRSA infection: ADD Vancomycin 1g IV infusion
• **Open cholecystectomy** • **Laparoscopic surgery where the patient has risk factors for post-operative infection**	Cefazolin 1g IV Or Inj. Piperacillin-Tazobactam 4.5 gm or Inj. Cefoperazone-Sulbactam 2 gm IV stat High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Gentamicin2mg/kg IV High risk of MRSA infection: ADD Vancomycin 1g IV infusion
• **Biliary Tract Surgery (Open Procedure**	Cefazolin 1 g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs. / Piperacillin-tazobactam (4.5 gm) OR Inj. Cefoperazone - Sulbactam 2gm IV stat & BD for 24hrs (maximum)	Clindamycin 900 mg OR Vancomycin1 gm + Gentamicin 5 mg/kg OR Metronidazole 500 mg + Gentamicin 5mg/kg
• **Pancreatic** • **Whipple's procedure, pancreatic necrosectomy, pancreatectomy** • **Liver resection**	Cefazolin1g IV OR Inj. Cefoperazone - Sulbactam 2gm IV stat & BD for 24hrs (maximum)PLUSMetronidazole 500mg IV infusion High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Gentamicin 2mg/kg IVPLUS Metronidazole 500mg IV infusion High risk of MRSA infection: ADD Vancomycin 1g IV infusion
• **Hernia repair with or without mesh insertion**	Cefazolin 1g IV If entry into the bowel lumen is expected:PLUS Metronidazole 500mg IV infusion High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Vancomycin 1g IV infusion OR If entry into the bowel lumen is expected give INSTEAD: Metronidazole 500mg IV infusion PLUS Gentamicin 2mg/kg IV

Cefazolin 2gm for patients ≥ 80 kg, 3 gm for patients ≥ 120 kg)
Vancomycin 1.5gm for patients more than 80kg actual body weight

B. Breast surgeries

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin allergy*
• Uncomplicated clean procedures (diagnostic excisional biopsy, stand-alone sentinel node biopsy, excision of scar tissue, lumpectomy (with or without needle or wire localisation))	Prophylaxis not recommended	
• Clean-contaminated procedures **(reduction mammoplasty, simple mastectomy, wide local excision, axillary lymph node clearance, nipple surgery, all repeat or revision procedures)**	Cefazolin1g IV OR Inj. Cefazolin 2gm or Inj. Cefuroxime 1.5gm IV stat High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Vancomycin 1g IV infusion
• Complicated clean-contaminated procedures **(prosthetic breast reconstruction surgery, prosthetic implant or acellular dermal matrix, autologous breast reconstruction surgery, breast augmentation surgery)**	Cefazolin1g IV OR Inj. Cefazolin 2gm or Inj. Cefuroxime 1.5gm IV stat High risk of MRSA infection: ADD Vancomycin 1g IV infusion POST-OPERATIVE: For breast reconstruction surgery, a further 2 doses of cefazolin (8 hours apart) can be considered	Vancomycin 1g IV infusion POST-OPERATIVE: For breast reconstruction or augmentation surgery, a single additional vancomycin dose 12 hours after the first dose can be considered
	Post-operative doses can be considered but prophylaxis (intravenous or oral) should not continue beyond 24 hours, even in the presence of surgical drains adjacent to the implant	

C. Cardiac surgeries

<table>
<tr><th>Surgery</th><th>Recommended Prophylaxis</th><th>High Risk Penicillin / Cephalosporin allergy*</th></tr>
<tr><td rowspan="3">• Coronary Artery Bypass Surgery (CABG)
• Cardiac Valve Surgery</td><td>Cefazolin1g IV OR Inj. Cefuroxime 1.5gm IV stat & BD for 72 hrs
HIGH risk of MRSA infection (e.g. reoperation of prosthetic valve):
ADD Vancomycin# 1 g IV infusion</td><td>Vancomycin# 1g IV infusion
PLUS
Gentamicin 5mg/kg IV (single dose only – do not give post-operative dose) OR Clindamycin 900 mg</td></tr>
<tr><td colspan="2">Postoperative doses can be considered for all cardiac procedures for up to 24 hours</td></tr>
<tr><td>Give Cefazolin 1g IV 8-hourly for another 2 doses commencing 8 hours after the first dose</td><td>If creatinine clearance > 40 mL/min, give 1 additional dose of vancomycin 1g IV infusion 12 hours after the first dose</td></tr>
<tr><td colspan="3">Teicoplanin may be given as an alternative to Vancomycin. A dose of 400mg IV (800mg for patients more than 80kg actual body weight) can be considered. If a post-operative dose is required, give 1 additional dose of Teicoplanin 400mg IV (800mg for patients more than 80kg actual body weight) 12 hours after the first dose.</td></tr>
</table>

Cefazolin 2gm for patients ≥ 80 kg, 3 gm for patients ≥ 120 kg)

Vancomycin 1.5gm for patients more than 80 kg actual body weight

D. Gynaecological surgeries

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin Allergy*
• **Hysterectomy** • **Gynaecological-oncological proceduress** • **Gynaecological laparotomy procedures (omentectomy, oophorectomy)** • **Pelvic organ prolapse procedures** • **Synthetic mid-urethral sling procedures** • **Vaginal repair**	Cefazolin1g IVPLUS Metronidazole 500mg IV infusion OR Cefuroxime (1.5 g IV) max. up to 48 hrs + Metronidazole 500 mg BL-BLI may be allowed. <u>High risk of MRSA infection:</u> ADD Vancomycin 1g IV infusion	Clindamycin 600mg IV infusion PLUS Gentamicin 2 mg/kg IV <u>High risk of MRSA infection:</u> Replace clindamycin with Vancomycin 1g IV infusion

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin Allergy*
• **Caesarean section (elective and non-elective)**	Cefazolin1g IV OR Cefuroxime (1.5 g IV): Single dose (pre-incision or after cord clamping) / max. up to 48 hrs. High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Clindamycin 600 mg IV infusion PLUS Gentamicin 2 mg/kg IV High risk of MRSA infection: Replace clindamycin with Vancomycin 1g IV infusion
• **Assisted vaginal delivery**	Amoxicillin+Clavulanate 1+0.2 g IV (as a single dose as soon as possible after assisted vaginal delivery, ideally within 6 hours) Moderate risk penicillin allergy: Cefazolin1 g IV (as a single dose as soon as possible after assisted vaginal delivery, ideally within 6 hours) PLUS Metronidazole 500mg IV (as a single dose as soon as possible after assisted vaginal delivery, ideally within 6 hours)	Clindamycin 600 mg IV infusion PLUS Gentamicin 2mg/kg IV
• **Prophylaxis for repair of obstetric anal sphincter injuries (including third- or fourth-degree perineal tears)**	Cefazolin1g IV PLUS Metronidazole 500 mg IV infusion OR Cefuroxime (1.5 g IV) max. up to 48 hrs + Metronidazole 500 mg High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Clindamycin 600mg IV infusion (as early as possible)
• **Plastic Surgery**	Cefazolin 1 g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs.	Clindamycin 900 mg or Vancomycin 15mg/kg

Cefazolin 2gm for patients ≥ 80 kg, 3 gm for patients ≥ 120 kg)
Vancomycin 1.5gm for patients more than 80kg actual body weight

E. Head - Neck surgeries

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin Allergy*
• **Head And Neck – Clean (Including Thyroidectomy)**	Cefazolin 1 g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs.	Clindamycin 900 mg
• **Head And Neck – Clean With Placement of Prosthesis**	Cefazolin 1 g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs.	Clindamycin 900 mg

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin Allergy*
• **Head And Neck – Clean Contaminated Surgery (all procedures involving** • **an incision through the oral or pharyngeal mucosa)**	Cefazolin 1 g IV / Cefuroxime (1.5 g IV) + Metronidazole (500 mg IV) max. up to 48 hrs. *BL – BLI or linezolid may be allowed in special cases.*	Clindamycin 900 mg

Cefazolin 2gm for patients ≥ 80 kg, 3 gm for patients ≥ 120 kg)
Vancomycin 1.5gm for patients more than 80kg actual body weight

F. Orthopaedic surgeries

Surgery	Recommended Prophylaxis	High Risk Penicillin / Cephalosporin Allergy*
• **Patients requiring revision / re-operation (joint replacement)**	Cefazolin1g IV OR Cefuroxime (1.5 g IV) + Metronidazole 500 mg PLUS Vancomycin 1g IV infusion THEN (postoperative): Cefazolin1 g IV 8-hourly for a further 2 doses PLUS Vancomycin 1g IV infusion single dose given 12 hours after initial dose	Vancomycin 1g IV infusion THEN (postoperative): Vancomycin1g IV infusion single dose given 12 hours after initial dose
Pre-existing infections (known or suspected) – if present, use appropriate treatment regimen instead of prophylactic regimen for procedure. Doses should be scheduled to allow for re-dosing just prior to skin incision.		
• **Spinal procedures**	Cefazolin1g IV OR Cefurox-ime (1.5 g IV) max. up to 48 hrs. High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Vancomycin 1g IV infusion
• **Internal fixation of fractures of large bones** • **Other (closed) internal fixation**	Cefazolin 1g IV OR Cefurox-ime (1.5 g IV) max. up to 48 hrs. High risk of MRSA infection: ADD Vancomycin 1g IV infusion	Vancomycin 1g IV infusion
• **Lower limb amputation**	Cefazolin1g IV OR Cefuroxime (1.5 g IV) max. up to 48 hrs. If limb is ischaemic: ADD Metronidazole 500mg IV infusion High risk of MRSA infection: ADD Vancomycin1g IV infusion	Vancomycin 1g IV infusion PLUS Gentamicin 2mg/kg IV (for procedures likely to continue for longer than 6 hours, consider using a 5mg/kg dose) If limb is ischaemic: ADD Metronidazole 500mg IV infusion

Cefazolin 2 gm for patients ≥ 80 kg, 3 gm for patients ≥ 120 kg)
Vancomycin 1.5 gm for patients more than 80kg actual body weight

Annexures

Annexure I

Standard doses of commonly used Antimicrobials

Name of the antimicrobials	Dosage
Amikacin	Systemic
	Adult dose: 15-20 mg/kg daily in a single dose
	Paediatric dose: 15-22.5 mg/Kg/day in 2-3 doses
Amoxicillin-clavulanate (co-amoxiclav)	Oral
	Adult dose: 500 mg-875 mg (amoxicillin) twice a day
	Paediatric dose: 40mg/kg/day (amoxicillin) in 2 doses 90mg/kg/day if penicillin resistant *S. pneumoniae* suspected 100mg/kg/day in otitis media
Amoxicillin-clavulanate (co-amoxiclav)	Intravenous
	Adult dose:1.2 gm thrice daily
	Paediatric dose: 40mg/kg/day (amoxicillin) in 2 doses 90mg/kg/day if penicillin resistant S. pneumoniae suspected 100mg/kg/day in otitis media
Ampicillin-Sulbactam	Intravenous
	Adult dose: 1.5 g to 3 g four times a day
Aztreonam	Intravenous
	Adult dose:1-2 g IV/IM q8-12hr; not to exceed 8 g/day
	Paediatric dose: 30-120 mg/kg/day q 6-8hrly
Cefazolin	Intravenous
	Adult dose:500 mg q 6-8 hrly
	Paediatric dose: 100 mg/kg/day in 3-4 divided doses
Cefepime	Intravenous
	Adult dose: 2gm twice daily

Name of the antimicrobials	Dosage
Cefixime	Oral
	Adult dose:400 mg or 200 mg twice daily
	Paediatric dose: 15 mg/kg/day in 2 divided doses, 20 mg/kg/day in 2 divided doses for enteric fever
Cefotaxime	Intravenous
	Adult dose:1 -2 gm 6-8 hourly
	Paediatric dose: 100 mg/kg/day in 3-4 divided doses, 200 mg/kg/day in 4 divided doses for meningitis
Ceftazidime	Intravenous
	Adult dose:1-2 gm q 12-24 hourly
	Paediatric dose: 100mg/kg/day, in meningitis 75-100mg/kg/day in 3 divided doses
Ceftriaxone	Intravenous
	Adult dose:1-2 gm q 12-24 hourly
	Paediatric dose: 50-100mg/kg/day in 2 divided doses Meningitis - 100mg/kg/day in 2 divided doses
Cefuroxime	Intravenous
	Adult dose:750mg -1.5gm q 8 hrly
	Paediatric dose: 75-100mg/kg/day in 3 divided doses
Ceftazidime/ Avibactam	Intravenous
	Adult dose:2.5 g (2 g/0.5 g) IV q8hr infused over 2 hr
Cefoperazone-Sulbactam	Intravenous
	Adult dose: The dose of Cefoperazone-Sulbactam is 3gm IV twice daily. Impaired Renal Function: Upto moderate Impairment: The dose of Cefoperazone-Sulbactam is 3 g IV twice daily. Severe Renal Dysfunction: The dose of Cefoperazone-Sulbactam is 1.5 gm IV twice daily plus Cefoperazone 1 gm IV twice daily.

Name of the antimicrobials	Dosage
Cefuroxime	Intravenous
	Adult dose:13 years and above 1gm IV infusion / IM once daily in 3-5ml lidocaine
	Paediatric dose: 75-100mg/kg/day in 3 divided doses
Ciprofloxacin	Intravenous / Oral
	Adult dose:250-750mg q 12 hourly
	Paediatric dose: 20-30mg/kg/day in 2 divided doses
Clindamycin	Intravenous
	Adult dose:150-300mg q 6-8 hourly (oral, iv) severe infections 300-600mg 8 hrly IV
	Paediatric dose: 40-60mg/kg/day in 3-4 divided doses
Colistin	Intravenous
	Adult dose: 9 million units loading dose following 4.5 mu BD
Ertapenem	Intravenous / Intramuscular
	Adult dose:750mg -1.5gm q 8 hrly
	Paediatric dose: 3 -12 years15mg/kg/day twice daily (not to exceed 1gm/day)
Gentamicin	Intravenous / Intramuscular
	Adult dose:1.3-6 mg/kg/day in 3 divided doses
	Paediatric dose: 5-7.5mg/kg/day in 2-3 divided doses
Imipenem/Cilastatin	Intravenous
	Adult dose: 2 gm daily (in 3-4 divided doses)
Linezolid	Intravenous / Oral
	Adult dose:600 mg twice daily (IV-infusion over 30-120 minutes)
	Paediatric dose: 10mg/kg/dose in 6-8 hourly
Meropenem	Intravenous
	Adult dose:1 gm q 8 hrly
	Paediatric dose: 7.5mg/kg/day /dose in meningitis
Metronidazole	Intravenous
	Adult dose: Oral:800 mg initially then 400 mg three times a day. Intravenous: 500 mg three times a day
	Paediatric dose: 7.5mg/kg/day in 3 divided doses

Name of the antimicrobials	Dosage
Moxifloxacin	Intravenous / Oral
	Adult dose: 400 mg (orally or as an intravenous infusion) once a day.
Nalidixic acid	Oral
	Adult dose: 1 gm q 6 hrly
	Paediatric dose: 8 mg/kg/day in 2 divided doses
Nitrofurantoin	Oral
	Adult dose:50 - 100mg/kg/day q 6 hourly (5-7mg/kg/day in 4 divided doses max dose 400mg)
	Paediatric dose: 8 mg/kg/day in 2 divided doses
Norfloxacin	Oral
	Adult dose: 1 gm q 8 hrly
	Paediatric dose: 20-30 mg/kg/day in 2 divided doses
Ofloxacin	Intravenous / Oral
	Adult dose:200 -400mg q 12 hourly
	Paediatric dose: 20 mg/kg/day in 2 divided doses
Piperacillin – Tazobactam	Intravenous
	Adult dose:4.5gm q 8 hourly
	Paediatric dose: 200-400 mg/kg/day in 3-4 divided doses
Polymyxin B	Intravenous
	Adult dose: 7.5 lac units BD
Tigecycline	Intravenous
	Adult dose:100 mg followed by 50 mg every 12 hrly infusion over 30-60 minutes. May be given upto 100 mg twice daily.
Vancomycin	Intravenous
	Adult dose:0.5gm q 6 hrly or 1 gm q 12 hrly
	Paediatric dose: 40-60 mg/kg/day in 3-4 divided doses

Annexure II

Irrational/Less Evidence Based Antibiotics Combination

1.	Amoxicillin-Tazobactam
2.	Cefadroxil-clavulanic acid
3.	Cefepime + Amikacin
4.	Cefepime-Sulbactam
5.	Cefepime-Tazobactam
6.	Cefixime + Ofloxacin
7.	Cefixime + Ornidazole
8.	Cefixime-Clavulanic acid
9.	Cefotaxime-Sulbactam
10.	Cefpodoxime-Clavulanic
11.	Ceftazidime-Tazobactam
12.	Ceftriaxone-Sulbactam
13.	Ceftriaxone-Tazobactam
14.	Cefuroxime-Clavulanic acid
15.	Cefuroxime-Sulbactam
16.	Meropenem-Sulbactam
17.	Vancomycin + Ceftriaxone
18.	Cefoperazone-Tazobactam
19.	Ampicillin-Amoxicillin-Cloxacillin
20.	Ceftazidime-Sulbactam
21.	Ofloxacin-Ornidazole/Tinidazole
22.	Gatifloxacin-Ornidazole
23.	Fluconazole-Tinidazole
24.	Doxycycline-Tinidazole
25.	Tetracycline-Metronidazole
26.	Cefixime/Cefadroxil + Ambroxol + Lactobacillus
27.	Ciprofloxacin/Gatifloxacin + Ambroxol

Annexure III

Protocol for Infection control in Patient Departments (IPD)/Critical Care Settings

Hospital acquired infections (HAIs) is a major safety concern for both health care providers and the patients. Considering morbidity, mortality, increased length of stay and the cost, efforts should be made to make the Critical care Unit as well as IPDs as safe as possible by preventing such infections.

These short guidelines have been developed for health care personnel involved in patient care in critical care areas and for persons responsible for surveillance and control of infections in hospital.

A. Patient at risk of nosocomial infections

There are patients, therapy and environment related risk factors for the development of nosocomial infections.

1. Age more than 70 years
2. High severity score
3. Shock
4. Major trauma
5. Renal failure
6. Coma
7. Prior antibiotics
8. Mechanical ventilation
9. Immuno-compromised – including drugs affecting the immune system (steroids, chemotherapy)
10. Indwelling catheters
11. The exposure to multiple invasive devices and procedures
12. ICU stay >3 days
13. Malnutrition

B. Factors related to inappropriate practices

Inadequate Hand washing facilities

- Frequent contact with patients by healthcare personnel.
- Patient close together

- Lack of isolation facilities
- No separation of clean & dirty areas
- Excessive and non-judicious antibiotic use
- Inadequate decontamination of items & equipment
- Inadequate cleaning of environment

C. Commonly acquired infections

- Ventilator Associated Pneumonia (VAP) & Tracheobronchitis (VAT)
- Catheter Related Blood Stream Infection (CRBSI)
- Community Acquired Urinary Tract Infection (CAUTI)
- Surgical Site Infection (SSI)
- Non VAP / VAT
- IV line associated or
- UTI associated with Foley's Catheter
- Skin & skin structure related infections following necrosis of skin
- Surgical site infection
- Nutritional therapy related Total Parenteral Nutrition (TPN)

D. Sources of Cross-Infection

- Hands of staff and attendants (via two-bowl hand washing and common towels or no handwashing)
- Assisted ventilation equipment
- Suction and drainage bottles
- I.V. lines – central and peripheral
- Urinary catheters
- Wounds and wound dressings;
- Disinfectant containers;
- Dressing trolleys (on which disinfectants jars/bottles are stored)

E. Strategies to Reduce Infections

1. Room sterilization
2. Isolation

3. Universal protocol
4. Device related protocol
5. Equipment sterilization
6. Disposal of waste
7. Procedural

1. Room sterilization:

i. Cleaning : Floor wash with available antiseptic (e.g. Phenyl) in the morning and evening, if not once per shift.

ii. Fumigation :

• For a general critical care unit it is not mandatory in ideal situation. But as we are far from reaching ideal and clean condition, it is better to undergo fumigation i.e. sterilization by aerosolized disinfectant.

• Target frequency - at an interval of 3 months (mainly for critical care set up). Mostly difficult to get IPD/CCU vacant because of continuous high turnover of patients. Alternative strategy is to fumigate at the earliest possible time when it can be rendered vacant for a short period. In CCU – each subunit is to be fumigated one by one. For example, if HDU is rendered vacant first, patient care is continued in ICU being shut off from HDU and vice versa.

Materials used :

• Hydrogen Peroxide: Preferred, required room closure for 2 hrs), Device used : Fogger machine.

• Formaldehyde :For each cubic metre of volume of the room, 20 ml Formaldehyde (40% solution) added in 20ml of water is placed in a kidney tray in the centre of the room. The kidney tray is placed beside the vent of a fan to promote dispersal. Ensure that the fan is switched on after the personnel leave the room. Contact time required is 6 hours. Example (GRH) Operation Theatre Volume = L×B×H = 180 cubic metres Formaldehyde required for fumigation = 20 ml for 1 cubic metre = So 3600 ml of formaldehyde required.

2. Isolation:

• Of highly infectious cases in isolation cubicle as constructed at least one in HDU. Examples of cases – Chicken Pox, Measles, HIV, Influenza (particularly epidemic & pandemic cases e.g. Swine Flu, Bird Flu), Dengue.

3. Universal protocol: Hand hygiene & Barrier protection:

i. Hand hygiene:

• Hands are the most common vehicle of transmission of organisms and therefore sinks

should be provided for proper hand washing in every CCU / HDU.

- All visitors and staff should wash their hands before direct contact with patients.
- Aseptic hand wash or alcohol based hand rub should be performed:
  - Before entering the ICU.
  - Before performing any invasive procedure including peripheral cannula insertion and removal.
  - Before every use of multidose vials.
  - Before administration of iv fluids or medications/drugs
  - Routine hand wash should be performed:
  - Before and after any contact with the patient
  - After touching environmental surfaces
  - Whenever soiled.

ii. Barrier protection

- Sleeper, Cap, Mask, Gown.
- Mandatory in isolation cubicle with additional protection in case of epidemic / pandemic.
- Sleeper although not required in ideal hospital situation, is to be followed out in our CCUs/HDUs.
- Cap, mask and gown are mandatory while coming in close contact e.g. airway toileting, airway procedures – intubation, tracheotomy, Putting a central line, lumber puncture, putting a chest drain etc. when there is chance of spillage of tissue of patient .
- Otherwise, all barrier protections are stringently followed in Surgical ICUs particularly speciality ICUS like NS – ICU, CTVS - ICU.

iii. Details of Personal protective equipment or barrier protection

a) Gloves:

- Sterile gloves should be worn after hand hygiene according to need (e.g., sterile for procedures using aseptic technique such as insertion of central venous catheter and non-sterile for procedures such as emptying urinary drainage bags, insertion of peripheral IV catheters, contact with contaminated surfaces or equipment)
- Clean, non-sterile gloves are safe for touching blood, other body fluids, contaminated items and any other potentially infectious materials
- Change gloves between tasks and procedures in the same patient especially when moving from a contaminated body area to a clean body area
- Never wear the same pair of gloves for the care of more than one patient
- Remove gloves after caring for a patient
- Practice hand hygiene whenever gloves are removed.

• Wear gloves for handling respiratory secretions or objects contaminated with respiratory secretions of any patient.

• Change gloves and decontaminate hands, as above:

- Between contacts with different patients.
- After handling respiratory secretions or objects contaminated with secretions from one patient.
- Before contact with object, or environmental surface.
- Between contacts with a contaminated body site and the respiratory tract of, or respiratory device on, the same patient.

b) Gown:

• Wear a gown to prevent soiling of clothing and skin during procedures that are likely to generate splashes of blood, body fluids, secretions or excretions; or when exposure to respiratory secretions from a patient is anticipated, and change it after soiling occurs and before providing care to another patient

• Plastic aprons may be worn when contact with patient body fluids is anticipated;

• The sterile gown is required only for aseptic procedures and for the rest, a clean, non-sterile gown is sufficient

• Remove the soiled gown as soon as possible, with care to avoid contamination.

c) Mask / Eye protection:

• Wear a mask (Disposable high-efficiency filter masks) and adequate eye protection to protect mucous membranes of the eyes, nose and mouth during procedures and patient care activities that are likely to generate splashes/sprays of blood and body fluids, etc.

• Patients, relatives and health care workers (HCWs) presenting with respiratory symptoms should also use masks (e.g. cough).

4. Device related protocol :

Daily check list is to be maintained

• Peripheral venous catheter :

- Change after every 3 days. If patient comes with PV Cath – in case coming from Emergency OPD – change immediately and if from the ward – 1st. change after 24 hrs. Avoid insertion in legs.

• Central venous catheter :

- Not to be changed routinely. Fresh replacement is done in case of strongly suspected / documented CV cath related infection by C/s test or mechanical problems like blockage / kinking. When indicated fresh insertion is done on the opposite side.

• IV Drip set :

- Needs to be changed daily.

• Ryle's tube :

- In case of malfunction or after every 5 – 7 days to avoid formation of biofilm and thereby preventing pneumonia.

• Tracheostomy tube:

- 1st change 48 hrs. of insertion and every after 24 hrs thereafter.

• Foley's catheter :

- Not to be changed routinely. Bladder wash is also abandoned except in selected uro-surgical conditions. In case of catheter block by sediment, controlled catheter wash may be cautiously tried avoiding bladder wash. These are to avoid vesico-ureteral reflux and UTI – sepsis.
- Change is indicated in case of malfunctioning catheter or infection strongly suspected / documented by culture.
- Closed system with two bags - Storage & collecting is preferred.

• Arterial Catheter and Pulmonary Arterial Catheter:

- These catheters need not to be changed routinely.

5. Equipment sterilization

i. Ventilator Circuit:

• For a particular patient on ventilator no tubing is routinely changed. Changed only when it is visibly contaminated or malfunctioning.

• Disposable tubes are disposed off after a single use.

• Reusable tubes & water traps are sterilized before applying on a new patient – by 2% Glutaraldehyde (Cidex) solution for ½ hour. It kills all microbes including HIV.

• Bacterial Filters - Disposables are for single use. Reusables are to be autoclaved.

• Humidifier is sterilized along with reusable tubes in 2% Glutaraldehyde solution.

• High efficiency heat & moisture exchanger filter (HMEF) when used as an alternative to inbuilt humidifier, is to be changed after every 3 days.

ii. Endotracheal suction Catheters:

• Closed suction catheters that incorporate a protective sleeve do not need to be changed every 72 hours. Studies have demonstrated these can safely be used on the same patient until the device is contaminated or malfunctions.

• More often, disposable suction catheters are used for respiratory tract suctioning. This device should be discarded after each use.

• The water used for flushing the catheter after each suction must be sterile and changed every time.

• Suction catheters must not be shared between patients. pa

iii. Endotracheal Tubes:

Preferably Disposable endotracheal tubes should be used.

iv. Ambu-bags:

These are used for resuscitation. Ambu-bags are extremely difficult to disinfect and become contaminated very quickly:

• Heat is the most reliable method of disinfection; 2% glutaraldehyde is a less acceptable method.

• The bags must be rinsed thoroughly in sterile water after immersion in glutaraldehyde. This will reduce the risk of chemical irritation, which can itself precipitate respiratory infection.

v. Oxygen Delivery masks:

These can be disposable or reusable;

• Wash thoroughly.

• Soak in alcohol for 10 minutes or soak in chlorine (500 ppm), rinse, dry and store.

• Disposable oxygen delivery masks should be preferred in critical care settings.

vi. Suction & drainage bottles:

These are usually disposable, with a self-sealing inner container held in a clear plastic outer container.

Non-disposable bottles:

• Must be changed every 24 hours (or sooner if full).

• The contents may be emptied down the toilet.

• Must be rinsed and autoclaved.

• Do not leave fluids standing in suction bottles.

6. Disposal of waste :

- Disposal protocol should be followed differently for general waste (concern is not more than household waste), cytotoxic waste, pharmaceutical waste, chemical waste and radioactive waste.
- For blood spillage in the unit, cleaning should be done at the earliest with paper towels followed by water and detergents.

- Laboratory spillage should be absorbed on to paper towels and disposed of as clinical waste. The contaminated surfaces should be treated with 2.0-2.5% sodium hypochlorite, left for 1 h and cleaned again with paper towels that are disposed of as clinical waste.
- It has been observed that HBV and HCV in dry blood remain infectious even when exposed to external environment for up to a week and 16 h respectively.
- Implications remain the same even if blood is invisible or not present in sufficient quantity. Considering this glucometers should be cleaned and disinfected filter every use to avoid contamination

7. Procedural Care :

Procedures requiring aseptic technique

(Intravenous Therapy, Urinary Catheterization & Respiratory Care Equipment /Practices)

i. IV care practices.

ii. Respiratory care - Patient-Based Interventions.

i. IV care practices:

• Clean injection ports with 70% alcohol or an iodophor before accessing the system.

• Cap all stopcocks when not in use.

• Use aseptic technique including a cap, mask, sterile gown, sterile gloves and a large sterile sheet for the insertion of central venous catheters (including Peripherally Inserted Central Catheter or PICCs) or guide wire exchange.

• Do not routinely replace central venous catheters, hemodialysis catheters, or pulmonary artery catheters.

• Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a non-infectious cause of fever is suspected.

• Do not routinely replace peripheral arterial catheters.

ii. Respiratory care - Patient-Based Interventions:

• If there is no medical contraindication, elevate the head of the bed of a patients who are at high risk for aspiration pneumonia, e.g., a person receiving mechanically assisted ventilation and/or who has an enteral tube in place, at an angle of 30 degree.

• Periodically drain and discard any condensate that collects in the tubing of a mechanical ventilator, taking precautions not to allow condensate to drain toward the patient. Decontaminate hands with soap and water or a waterless antiseptic agent after performing the procedure or after handling the fluid.

• If available, use an endotracheal tube with a dorsal lumen above the endotracheal cuff to allow drainage (by continuous suctioning) of tracheal secretions that accumulate in the patient's subglottic area.

• Use sucralfate, H2-blockers, PPIs and/or antacids interchangeably for stress-bleeding prophylaxis in a patient receiving mechanically assisted ventilation (H2-blockers alone decrease gastric acidity and increase gastric colonization and increases the susceptibility to respiratory infections).

• Instruct preoperative patients, especially those at high risk of contracting pneumonia, regarding taking deep breaths and ambulating as soon as medically indicated in the postoperative period. High-risk patients include those who will have an abdominal, thoracic, head or neck operation or who have substantial pulmonary dysfunction.

• Follow manufacturers' instructions for use and maintenance of wall oxygen humidifiers.

• Between patients, change the tubing, including any nasal prongs or mask used to deliver oxygen from a wall outlet.

• Small-volume medication nebulizers: "in-line" and hand-held nebulizers: Between treatments on the same patient, disinfect; rinse with sterile or pasteurized water; and air-dry small-volume in-line or hand-held medication nebulizers.

• Use only sterile or pasteurized fluid for nebulization and dispense the fluid into the nebulizer aseptically.

• If multidose medication vials are used, then handle, dispense, and store them according to manufacturers' instructions using sterile techniques.

• Total Parenteral Nutrition to be infused through central line and not beyond 12 hrs at a time.

F. Specific strategies focused on prevention of specfic nosocomial infections

In addition to the standard and transmission-based precautions, there are several strategies focused on prevention of specific nosocomial infections in critically ill patients. Of these, ventilator-associated pneumonia (VAP), catheter-related bloodstream infection (CRBSI) and urinary tract infection (UTI) are the most important.

i. Strategies to reduce ventilator-associated pneumonia (VAP)

• Avoid intubation whenever possible

• Consider non-invasive ventilation whenever possible

• Prefer oral intubations to nasal unless contraindicated

• Keep head elevated at 30°-45° in the semi-recumbent body position

• Daily oral care with chlorhexidine solution of strength 0.12%

• Daily sedation vacation if feasible and assessment of readiness to extubate

• Avoid re intubation whenever possible

• Routine change of ventilator circuits is not required

• Monitor endotracheal tube cuff pressure (keep it >20 cm H2 O) to avoid air leaks around the cuff, which can allow entry of bacterial pathogens into the lower respiratory tract

• Prefer endotracheal tubes with a subglottic suction port to prevent pooling of secretions around the cuff leading to micro-aspiration

• Closed endotracheal suction systems may be better than the open suction

• Periodically drain and discard any condensate that collects in the tubing of a mechanical ventilator.

ii. Strategies to reduce Catheter-Related Blood Stream Infection or CRBSI

• Prefer the upper extremity for catheter insertion. Avoid femoral route for central venous cannulation (CVC)

• If the catheter is inserted in a lower extremity site, replace to an upper extremity site as soon as possible

• Use maximal sterile barrier precautions (cap, mask, sterile gown and sterile gloves) and a sterile full-body drape while inserting CVCs, peripherally inserted central catheters, or guidewire exchange

• Clean skin with more than 0.5% chlorhexidine preparation with alcohol (usually 2% chlorhexidine with 70% w/v ethanol) before CVC, arterial catheter insertion, etc.,

• Use chlorhexidine/silver sulfadiazine or minocycline/rifampicin-impregnated CVCs when the catheter is expected to remain in place for more than 5 days and only if the bloodstream infection rates are high in the unit despite successful implementation of measures to reduce CRBSI

• Use ultrasound-guided insertion if technology and expertise are available

• Use either sterile gauze or sterile, transparent, semi permeable dressing to cover the catheter site. Replace the catheter site dressing only when the dressing becomes damp, loosened, or visibly soiled

• Evaluate the catheter insertion site daily and check if a transparent dressing is present and palpate through the dressing for any tenderness

• Insertion date should be put on all vascular access devices

• Use 2% chlorhexidine wash daily for skin cleansing to reduce CRBSI

• Clean injection ports with an appropriate antiseptic (chlorhexidine, povidone-iodine, an iodophor, or 70% alcohol), accessing the port only with sterile devices. Cap stopcocks when not in use

• Assess the need for the intravascular catheter daily and remove if not required

• Peripheral lines should not be replaced more frequently than 72-96 h. Routine replacement of CVCs is not required

• Replace administration sets, including secondary sets and add-on devices, every day in patients receiving blood, blood products, or fat emulsions

• If other intravenous fluids are used, change not <96-h intervals and at least every 7 days

• Needleless connectors should be changed frequently (every 72 h)

• Replace disposable or reusable transducers at 96-h intervals.

iii. Strategies to reduce UTI

• Insert catheters only for appropriate indications

• Follow aseptic insertion of the urinary catheter

• Maintain a closed drainage system

• Maintain unobstructed urine flow. At all times the urinary catheter should be placed and taped above the thigh and the urinary bag should hang below the level of the bladder

• The urinary bag should never have floor contact

• Changing indwelling catheters or drainage bags at fixed intervals is not recommended. Change only if there are clinical indications such as infection or obstruction, or when the closed system is compromised

• Remove the catheter when it is no longer needed.

G. Patients needing ICU care should be assessed for:

• Diarrhoea,

• Rashes or skin conditions;

• Recognized communicable disease;

• Known carrier of an epidemic strain of bacterium;

• Isolation: Patients suspected or known to have communicable diseases should be admitted directly to an isolation cubicle in the ICU or referred to a higher centre

H. Regarding Helath care workers:

• All staff working in the unit should be offered hepatitis B vaccine before beginning work in the unit.

• Orientation to the unit should include basic infection control concepts that include hand hygiene, management of sharps, and associated risks of disease transmission.

• Training and education should include formal and informal infection control lectures and assessment of practices through periodic observations.

Annexure IV

Guideline for Antimicrobial Susceptibility Testing

It is proposed that the following Antibiotics to be tested for the particular samples and respective organisms by the Microbiology Laboratories

1. Blood, pus and other body fluids culture and sensitivity

A. *Salmonella sp, Shigella sp*

Antibiotics to be tested:

- Azithromycin
- Ciprofloxacin
- Ampicillin
- Cotrimoxazole
- Chloramphenicol
- Pefloxacin
- Cefixime
- Piperacillin/Tazobactam
- Ceftriaxone
- Amoxicillin/Clavulanic Acid
- Imipenem
- Meropenem
- ESBL Screening : Cefotaxime, Cefotaxime-Clavulanic Acid;
- Amp C Screening : Cefoxitin
- Colistin (Only Report MIC)

B. *Escherichia coli, Klebsiella pneumonia and other Enterobacterales*

Antibiotics to be tested:

- Ampicillin
- Ciprofloxacin
- Cotrimoxazole
- Amikacin
- Piperacillin/Tazobactam
- Cefoperazone/Sulbactam
- Ceftriaxone
- Ertapenem
- Aztreonam *
- Amoxicillin-Clavulanic Acid
- Imipenem
- Meropenem
- Cefepime
- Ceftazidime/Avibactam *
- Doxycycline orMinocycline
- ESBL Screening : Cefotaxime, Cefotaxime-Clavulanic Acid;
- Amp C Screening : Cefoxitin
- Colistin (Only Report MIC)

C.*Enterococcus sp*

Antibiotics to be tested:

- Ampicillin
- High level gentamicin
- Ciprofloxacin
- Linezolid
- Vancomycin
- Erythromycin
- Teicoplanin
- Amoxycillin/Clavulanic acid
- Tetracycline or Doxycycline

D. *Staphylococcus aureus, Coagulase negative Staphylococcus*

Antibiotics to be tested:

- Cefoxitin [For MRSA detection, not to be reported]
- Amikacin
- Teicoplanin
- Erythromycin*
- Doxycycline or Tetracycline
- Clindamycin *
- Oxacillin
- Vancomycin
- Penicillin-G
- Linezolid
- Ciprofloxacin or Levofloxacin or
- Moxifloxacin
- Gentamicin
- Chloramphenicol

E .*Pseudomonas sp*

Antibiotics to be tested:

- Amikacin
- Meropenem
- Tobramycin
- Cefepime
- Netilmicin
- Gentamicin
- Aztreonam *
- Colistin (Only Report MIC)
- Piperacillin/Tazobactam
- Cefoperazone-Sulbactam
- Ceftazidime
- Ceftazidime-Avibactam *
- Imipenem
- ESBL Screening : Ceftazidime, Ceftazidime-Clavulanic Acid

F. *Pneumococcus (on 5% sheep blood agar)*

Antibiotics to be tested:

- Penicillin
- Clindamycin
- Ampicillin
- Vancomycin
- Cotrimoxazole
- Linezolid
- Erythromycin
- Optochin [for diagnosis- not to be reported]
- Tetracycline
- Chloramphenicol
- Levofloxacin or Moxifloxacin

G. *Beta haemolytic Streptococci (on 5% sheep blood agar)*

Antibiotics to be tested:

- Penicillin
- Chloramphenicol
- Ampicillin
- Tetracycline
- Cotrimoxazole
- Clindamycin
- Erythromycin
- Vancomycin
- Bacitracin [Not to be reported]
- Linezolid

H. *Acinetobacter sp*

Antibiotics to be tested:

- Piperacillin/Tazobactam (100/10 ug)
- Minocycline
- Ceftazidime
- Ciprofloxacin
- Ticarcillin/Clavulanic Acid (75/10 ug)
- Cotrimoxazole
- Amikacin
- Colistin (Only Report MIC)
- Cotrimoxazole
- ESBL Screening: Ceftazidime, Ceftazidime/ Clavulanic Acid
- Meropenem
- Imipenem
- Cefoperazone-Sulbactam

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2. Urine culture and sensitivity

A. *Escherichia coli, Klebsiella pneumonia and other Enterobacterales*

Antibiotics to be tested:

- Nitrofurantoin
- Meropenem
- Fosfomycin
- Cotrimoxazole
- Ciprofloxacin
- Colistin (Only Report MIC)
- Amikacin
- Ertapenem
- Piperacillin/Tazobactam (100/10 ug)
- Cefoperazone/Sulbactam
- Ceftriaxone
- ESBL Screening : Cefotaxime, Cefotaxime-Clavulanic Acid;
- AmpC Screening : Cefoxitin
- Amoxicillin/Clavulanic Acid (20/10 ug)

B. *Acinetobacter sp*

Antibiotics to be tested:

- Piperacillin/Tazobactam (100/10 ug)
- Minocycline
- Ceftazidime
- Ciprofloxacin
- Ticarcillin/Clavulanic Acid (75/10 ug)
- Cotrimoxazole
- Amikacin
- Colistin (Only Report MIC)
- Imipenem
- Cefoperazone-Sulbactam
- Meropenem
- ESBL Screening : Ceftazidime, Ceftazidime/Clavulanic Acid

C. *Pseudomonas sp*

Antibiotics to be tested:

- Amikacin
- Imipenem
- Tobramycin
- Meropenem
- Netilmicin
- Cefepime
- Aztreonam
- ESBL Screening : Ceftazidime, Ceftazidime-Clavulanic Acid
- Piperacillin/Tazobactam (100/10 ug)
- Ceftazidime
- Colistin (Only Report MIC)
- Cefoperazone-Sulbactam

D. *Enterococcus sp*

Antibiotics to be tested:

- Ampicillin
- Linezolid
- Ciprofloxacin
- Nitrofurantoin
- Vancomycin
- Fosfomycin
- High level Gentamicin (120 ug)
- Amoxycillin-Clavulanic Acid
- Teicoplanin

E. *Staphylococcus aureus and Coagulase negative Staphylococcus*

Antibiotics to be tested:

- Cotrimoxazole
- Amikacin
- Ciprofloxacin
- Cefoxitin(30 ug)[For MRSA Detection]
- Vancomycin
- Nitrofurantoin
- Linezolid
- Gentamicin
- Teicoplanin
- Oxacillin

[**Note :**

a) Cefotaxime-Clavulanic Acid only for ESBL Screening, not to be reported

[ESBL Screening :by Ceftazidime-Clavulanic Acid or Cefotaxime-Clavulanic Acid]

b) Pefloxacin: surrogate marker for ciprofloxacin. Report results as ciprofloxacin susceptible or resistant based on pefloxacin test result.

c) Ceftazidime-Avibactam and Aztreonam: Put at 15 mm distance edge to edge to demonstrate synergy

d) For detection of inducible clindamycin resistance: Put Erythromycin and Clindamycin discs 15 mm edge to edge.]

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