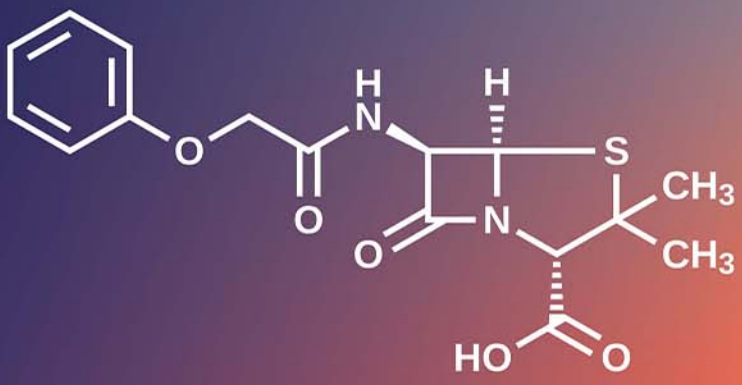
ed information on pharmacology books, visit our website www.ejaypee.com, for detailed information on pharmacology books, visit our website www.ejaypee.com

Antibiotic Manual



Editors-in-Chief
Arijit Sinha
Subhrojyoti Bhowmick

Forewords
Jyotirmoy Pal
Santa Sabuj Das

JAYPEE

Contents

1. **Misuse of Antibiotics** 1
   Arijit Sinha
2. **Good Clinical Practice** 6
   Saibal Das, Subhasri Bandyopadhyay, Sanskriti Shukla
3. **Antimicrobial Stewardship** 18
   Soumendra Nath Haldar, Navin Kumar Yadav
4. **Pharmacokinetic and Pharmacodynamic Parameters Governing Antibiotic Usage** 29
   Subhrojyoti Bhowmick
5. **Antibiotic Formulary and Restriction of Antibiotic Use** 34
   Ananya Mandal
6. **Mechanism of Action of Antimicrobials** 44
   Shaikh Mohammad Rafi, Pratik Chatterjee, Ashok K Shenoy
7. **Dose Modification of Antibiotics with Organ Dysfunction** 51
   Malati Murmu, Lagendra Kumar Singh, Manoranjan Naik, Siddhant Mahapatra, Tuhin Hati
8. **Interpretation of Antimicrobial Resistance Genes and Antimicrobial Selection in the Indian Setting** 72
   Debkishore Gupta
9. **Revisiting: Antibiotics of Lesser Use** 79
   Sangeeta Sharma, Ankita Roy
10. **Newer Antibiotics** 110
    Anant Patil, Ankita Roy, Subhrojyoti Bhowmick
11. **Principles of Antibiotic and Related Drug Use in Immunocompromised Patients with Infection** 119
    Ayan Basu
12. **Antibiotics in Surgery** 151
    Indranil Sau
13. **Antibiotics in Orthopedics** 164
    Kiran Kumar Mukhopadhyay, Sudipta Samanta
14. **Principles of Antibiotic Therapy in Hematology Related Diseases** 176
    Tuphan Kanti Dolai, Kaustav Ghosh, Badal Kumar Sahu

15. **Antibiotics in Nephropharmacology** 189
Vamsi Krishna Nagalla, Tarun Kumar Saha

16. **Antibiotics in Neurology Practice** 217
Aradhya Sekhar Bagchi, Parul, Ananda Bagchi

17. **Antibiotics in Cardiology** 230
Prantik Bhattacharya, Ansuman Saha

18. **Antibiotics in Respiratory Diseases** 237
Sumanta Jha

19. **Overview of Treatment of Tuberculosis** 256
Avishek Layek

20. **Antibiotics in Rheumatology Practice** 263
Sourav Pradhan, Angan Karmakar

21. **Antibiotics in Gastroenterology** 270
Partha Sarathi Patra, Amit Bagrodia

22. **Antibiotics in Endocrinology Practice** 280
Kaushik Sen, Partha Sarathi Choudhury

23. **Principles of Antibiotic Use in the Geriatric Population** 293
Arunansu Talukdar, Upasana Ghosh

24. **Antibiotics in Tropical Diseases** 299
Arun Chaudhuri, Tushar Modak, Subhajit Das

25. **Cancer: Infectious Diseases—Antibiotics** 304
Rupayan Kundu

26. **Antibiotics Used in Obstetrics and Gynecology** 320
Soumyajit Pal, Abhijit Kumar Sinha, Riya Dhali

27. **Antibiotics and Pregnancy** 332
Rajit Bhattacharyya, Arunabha Das

28. **Antibiotics in Pediatrics** 336
Sanjukta Dey, Sayani Biswas

29. **Antibiotics in Eye and ENT Infections** 347
Manas Kumar Ghosh, Arijit Sinha, Bibekananda Chakraborti

30. **Antibiotics in Skin and Soft Tissue Infections** 355
Rajat Sadhukhan, Mrityunjay Pal

31. **Antibiotics in Management of Sepsis** 360
Ritwik Ghosh, Arijit Sinha

32. **Antibiotic Prophylaxis** 382
Dolly Roy, Vijoy Sankar Kairi, Nivedita Saha

Index ***393***

CHAPTER 1

Misuse of Antibiotics

Arijit Sinha

JAYPEE BROTHERS

INTRODUCTION

Antibiotic misuse, encompassing abuse, overuse, incorrect indications, improper dosing, inadequate duration, self-medication, and over-the-counter sales, poses a severe global threat to health, society, and antimicrobial efficacy. Approximately 50% of antibiotics prescribed worldwide are inappropriate, with 28% misuse in outpatient settings per CDC data, and studies showing one in seven patients receiving unnecessary prescriptions in 2016 alongside high overuse in conditions like pneumonia (56.9%) and UTIs (38.7%). India leads in antibiotic consumption, doubling over 15 years, particularly in rural areas with drugs like azithromycin and ciprofloxacin from the WATCH group, fueling antimicrobial resistance (AMR). This chapter explores misuse types, risks including superbugs and gut microbiota disruption, prevention strategies like stewardship programs and legal measures, patient responsibilities, and India's national action plans.

DEFINITION

Antibiotic misuse, abuse, or overuse is a global problem. When is it called misuse? While using antibiotics when indication is incorrect, dose is not adequate, duration is not proper by treating doctor or use of antibiotic by self-medication, over-the-counter (OTC) sale are called misuse. It is hazardous to health, society, and antimicrobial kingdom.

CURRENT SCENARIO

About 50% of antibiotics prescribed globally are inappropriate. According to the Centers for Disease Control and Prevention (CDC) 28% misuse of antibiotics are in outpatient department (OPD). Study by Chua et al., published an article at British Medical Journal (BMJ) shows that one in seven patient received unnecessary antibiotics in the year 2016. Another study published in Clinical Infectious Journal (September 2020) showed 56.9% with pneumonia, 38.7% with urinary tract infection (UTI) patients had overuse of drugs. India is the country with highest consumption of antibiotics and it doubles in last 15 years. Most of misuses are in rural areas and are of WATCH group (Azithromycin, Ciprofloxacin). Misuse of antibiotics is dangerous for development of antimicrobial resistance (AMR).

TYPES OF MISUSE

Antibiotic misuse may be of several types—self-medication, OTC sale, unnecessary prescription, improper dose and duration. Lack of health consciousness, lack of pharmacist in retail counter, and financial problem are important causes of misuse. Self-medication and OTC sale of antibiotic are mainly due to common illness such as common cold, flu, bronchitis, sore throat, and gastroenteritis without knowing the cause whether viral or bacterial. Taking wrong dose and duration is also another important aspects of misuse. Antibiotic dose must be according to body weight or standard protocol and dose duration must be proper, otherwise antibiotic resistance will develop. Antibiotic used in cough and cold, which are mostly viral are unnecessary and they can create many side effects of the drugs. Another important misuse of antibiotic observed in dysuria cases, where patient took antibiotics as self-medication and stopped prematurely when they improved symptomatically. Apart from human use antibiotic in animal husbandry and agriculture use are often misused. This may be important cause of antibiotic resistance. Precaution to be taken by concerned authorities.

RISK/HAZARDS

According to CDC one-third cases of antibiotic use are incorrect. The prime concern of antibiotic misuse is development of antibiotic resistance. Emergence of

JAYPEE BROTHERS

"superbugs"—resistant to several antibiotics is a great problem. Adverse reactions to drugs, interaction with other drugs, and disruption of gut microbiota are other important hazards of misuse. Misuse also causes unnecessary economic burden and environmental problems. Structural change of bacteria and production of antibiotic modifying enzymes are important drawbacks. For example, aminoglycoside modifying enzymes are responsible for aminoglycoside drug resistance. Similarly, β-lactamase enzymes produce resistance to β-lactam antibiotics (penicillins, cephalosporins, carbapenems, monobactams, etc.). Inadvertent use of antibiotics in human, in agriculture, and aquaculture leads to antibiotic pollution on earth. It causes presence of antibiotics in water, soil, and air and helps in antibiotic resistance. Pharmaceutical waste of antibiotics in environment also responsible for drug resistant bacteria. Infection due to drug resistant organism causes serious illness, prolonged recovery, prolonged hospital stay, use of higher antibiotics, and more economic burden. Ultimately misuse of antibiotic leads to increased morbidity and mortality.

PREVENTION

Misuse can be prevented by several ways. OTC sale of antibiotic should be stopped. During selling by the chemist shop, one must ask for prescription of registered medical practitioner. Healthcare provider will diagnose the disease properly by clinical eyes and investigations before using antibiotics. Judicious use is mandatory. Patients should be advised properly regarding dose and duration and adverse effects of drugs. They should understand that abrupt cessation of antibiotic can create several problems. Patient should not create pressure on doctor to prescribe antibiotics and they should maintain good personal hygiene. Antibiotic stewardship program, monitoring and awareness among common people, use of alternative therapies such as bacteriophage, antibodies, and antimicrobial peptides are important aspects for prevention of bacterial resistance from misuse. Use of antibiotics in veterinary or in agriculture should be restricted. Vaccination in proper dose and schedule should be stressed. Healthcare infrastructure should be improved. To make awareness among healthcare workers and common people, World Health Organization (WHO) celebrates 18th to 24th November as world antimicrobial awareness (WAAW) week every year. Prescription audit, bound to follow instruction,

JAYPEE BROTHERS

antibiotic policy, and legal steps may improve the scenario.

LEGAL ASPECTS

Legal steps are necessary to prevent formation of antibiotic resistant by misusing drugs. Effective surveillance system, monitoring of prescriptions, and enforcement of laws are necessary for human and veterinary practice. International bodies such as WHO Executive Board, G7 Health Ministers, and United Nations are monitoring misuse globally. National action plan on AMR was launched in 2018. National surveillance system of antibiotic resistance was formed to assess antibiotic use and misuse in India. Regulatory authority of central and state level will monitor rational use of antibiotics. Kerala government has taken two important action plans to prevent AMR and misuse along with National Action. One is the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) and another is Antimicrobial Resistance Intervention for Total Health (AMRITH). Aim is to stop OTC sale of antibiotics and to prevent misuse. There is sharp drop of irrational use of antibiotics and fallen about 1,000 crore rupees in the sale of antibiotics during 1 year. Government of India, Drug Controller General of India (DCGI) has taken some steps to prevent misuse like—banning fixed dose combination, issuing advisories to state drug controller to ensure that antibiotics should not be used without prescription of doctors, prevent use of antibiotics in animal feed, initiation of antibiotic stewardship program in hospital, awareness campaign in teaching institutions, and upbringing of knowledge among healthcare workers.

RESPONSIBILITIES OF PATIENTS

Patients have important role in prevention of misuse of antibiotics. Take antibiotics only when prescribed by registered medical practitioner. Do not skip dosage and do not stop prematurely. Self-medication and OTC sale of antibiotics are to be stopped.

CONCLUSION

Misuse of antibiotic is an important problem in clinical practice. It will create formation of superbug and antibiotic resistance. Rational use of antibiotic is mandatory and more legal action or laws are necessary to prevent misuse.

JAYPEE BROTHERS

FURTHER READINGS

1. Singh B, Bhat A, Ravi K. Antibiotic Misuse and Antimicrobial Resistance Development in Agriculture: A Global Challenge. Environ Health. 2024;2(9):618-22.
2. Islam W Md, Shahjahan M, Azad A K, et al. Factors Contributing to Antibiotic Misuse Among Parents of School-going children in Dhaka City, Bangladesh. Nature Sci Rep. 2024;14(1):2318.
3. Kilari BV, Oroszi T. The Misuse of Antibiotics and the Rise of Bacterial Resistance: A Global Concern. Pharmacology & Pharmacy. 2024;15(12):508-23.

JAYPEE BROTHERS

for detailed information on pharmacology books, visit our website www.ejaypee.com, for detailed information on pharmacology books, visit our website www.ejaypee.com

Antibiotic Manual

Salient Features

- **Expert co-editorship:** Blends clinical expertise from Professor Dr Arijit Sinha in infectious diseases with Professor Dr Subhrojyoti Bhowmick's authority in clinical pharmacology, ensuring pragmatic and rigorous guidance on antimicrobial therapy
- **Comprehensive coverage:** Spans foundational principles like pharmacokinetics, mechanisms of action, stewardship, and resistance interpretation, alongside specialty chapters for surgery, pediatrics, geriatrics, sepsis, and India-specific issues like tuberculosis
- **Practical tools:** Features structured algorithms, stepwise differential diagnoses, dose modifications, and formulary strategies to support evidence-based prescribing and clinical decision-making
- **AMR-focused approach:** Addresses misuse consequences, good clinical practices, and institutional stewardship to promote rational use, combat resistance, and optimize outcomes across diverse patient populations



Arijit Sinha MD(General Medicine) DNB(General Medicine) FICP presently serves as Professor in the Department of General Medicine at Nil Ratan Sircar Medical College and Hospital, Kolkata, West Bengal, India. A distinguished clinician, academician, and researcher, Dr Sinha has over 30 years of experience and has treated patients at the Infectious Disease Hospital, Kolkata, for several years. Dr Sinha has an extensive body of work comprising over 30 publications in reputed national and international journals. He has made notable contributions to the Association of Physicians of India (API) textbooks/API updates. His exceptional dedication to medical education has earned him recognition from several academic bodies, including the Medical Education Day Celebration Committee, for his excellence in teaching. Dr Sinha commenced his professional journey as a physician and has rendered service across multiple regions of West Bengal. In addition to his academic and clinical endeavors, he is a prolific writer and an active social worker associated with numerous charitable organizations committed to public welfare.



Subhrojyoti Bhowmick MD(Pharmacology) FRCP(London) FRCP(Edinburgh) EPHM(IIM Calcutta) is an accomplished clinician, academic leader, and internationally recognized expert in clinical pharmacology, patient safety, and healthcare quality. An MBBS and MD in Pharmacology Executive Program in Healthcare Management from IIM Calcutta, he currently serves as Professor and Head, Department of Pharmacology, Jagannath Gupta of Medical Sciences and Hospital, North Kolkata, Sodepur, West Bengal. His distinguished career spans over 17 years across India, the United States, and global health agencies. A Fellow of the Royal College of Physicians of Edinburgh and London, Dr Bhowmick also holds advanced certifications in Patients Safety from Johns Hopkins University, USA; Stanford University, USA; and ISQua, UK. He was the first Indian doctor to receive the prestigious ISQua Lucian Leape Patient Safety Fellowship Award (2019), reflecting his pioneering work in medication safety and clinical excellence. His experience as an Volunteer Staff in Patient Safety Unit, WHO, Geneva in 2019. He has served as a Visiting Scholar at Harvard, Senior Research Associate at Stanford University School of Medicine, and Honorary Lecturer at the University of Birmingham, UK. His contributions include leading clinical research units, guiding postgraduate trainees, and developing medication safety frameworks for the Government of India. An active researcher and editorial board member of the Drug Safety Journal, Dr Bhowmick has authored numerous peer-reviewed publications and book chapters, bringing depth, authority, and real-world insight to his writing.

Shelving Recommendation
PHARMACOLOGY

ISBN 978-93-7545-900-2

Buy from ejaypee

JAYPEE BROTHERS