

Antibiotics explained: Understanding their types, uses, benefits, risks, and effective strategies for proper use and resistance prevention.

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Introduction

Antibiotics are powerful medications used to treat infections caused by bacteria. They have revolutionized modern medicine by effectively combating bacterial diseases and saving countless lives. However, their misuse and overuse have led to the emergence of antibiotic-resistant bacteria, posing a significant challenge to public health. This article provides an in-depth look at antibiotics, including their types, uses, benefits, risks, and strategies for their effective use and resistance prevention.

Description

What are antibiotics?

Antibiotics are drugs that inhibit the growth of bacteria or kill them outright. They work by targeting specific bacterial structures or functions, such as cell wall synthesis, protein synthesis, or DNA replication. Antibiotics are not effective against viral infections, such as the common cold or influenza.

Types of antibiotics

Antibiotics are classified based on their mechanism of action and the spectrum of bacteria they target:

Beta-lactams

Description: These antibiotics contain a beta-lactam ring and inhibit bacterial cell wall synthesis.

Examples: Penicillins (e.g., penicillin, amoxicillin), Cephalosporins (e.g., cephalexin, ceftriaxone).

Macrolides

Description: These antibiotics inhibit bacterial protein synthesis by binding to the 50S ribosomal subunit.

Examples: Erythromycin, Azithromycin, Clarithromycin.

Tetracyclines

Description: These antibiotics inhibit bacterial protein synthesis by binding to the 30S ribosomal subunit.

Examples: Doxycycline, Tetracycline, Minocycline.

Fluoroquinolones

Description: These antibiotics inhibit bacterial DNA gyrase and topoisomerase IV, interfering with DNA replication.

Examples: Ciprofloxacin, Levofloxacin, Moxifloxacin.

Aminoglycosides

Description: These antibiotics inhibit bacterial protein synthesis by binding to the 30S ribosomal subunit.

Examples: Gentamicin, Tobramycin, Amikacin.

Sulfonamides

Description: These antibiotics inhibit bacterial folic acid synthesis by competing with Para-Aminobenzoic Acid (PABA).

Examples: Sulfamethoxazole, Sulfadiazine.

Glycopeptides

Description: These antibiotics inhibit bacterial cell wall synthesis by binding to D-alanyl-D-alanine.

Examples: Vancomycin, Teicoplanin.

Uses of antibiotics

Antibiotics are used to treat a variety of bacterial infections, including:

Respiratory infections: Such as pneumonia, bronchitis, and sinusitis.

Urinary Tract Infections (UTIs): Including cystitis and pyelonephritis.

Skin infections: Such as cellulitis, impetigo, and abscesses.

Sexually Transmitted Infections (STIs): Including gonorrhea, chlamydia, and syphilis.

Gastrointestinal infections: Such as bacterial gastroenteritis and *Helicobacter pylori* infection.

Benefits of antibiotics

Effective treatment: Antibiotics can cure bacterial infections, preventing complications and improving patient outcomes.

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Preventive use: Antibiotics are sometimes used prophylactically before surgeries or in certain high-risk situations to prevent infections.

Reduced transmission: By treating infections, antibiotics help reduce the spread of bacterial diseases within communities.

Risks and challenges

Antibiotic resistance

Description: The ability of bacteria to resist the effects of an antibiotic that they were once sensitive to.

Causes: Overuse and misuse of antibiotics, such as incomplete courses or unnecessary prescriptions, contribute to resistance.

Consequences: Resistant infections are harder to treat, require alternative and often more expensive treatments, and can lead to longer illness or increased mortality.

Side effects

Common side effects: Nausea, diarrhea, and allergic reactions.

Serious side effects: Severe allergic reactions (anaphylaxis), Clostridium difficile infection (associated with antibiotic-associated colitis), and kidney or liver toxicity.

Disruption of normal flora

Description: Antibiotics can disrupt the balance of beneficial bacteria in the body, leading to opportunistic infections such as yeast infections or Clostridium difficile-associated diarrhea.

Strategies for proper use and resistance prevention

Appropriate prescribing

Accurate diagnosis: Ensure that antibiotics are prescribed only for bacterial infections and not for viral infections.

Correct selection: Choose the appropriate antibiotic based on the specific bacterial pathogen and its susceptibility.

Completing the full course

Adherence: Patients should complete the full course of antibiotics as prescribed, even if symptoms improve before the medication is finished.

Avoiding self-medication

Prescription use: Avoid using leftover antibiotics or taking antibiotics without a prescription, as this can contribute to resistance.

Infection prevention

Hygiene: Practice good hygiene, such as regular handwashing, to prevent the spread of infections.

Vaccination: Get vaccinated against bacterial diseases where vaccines are available to reduce the need for antibiotics.

Monitoring and surveillance

Tracking resistance patterns: Healthcare providers and public health agencies should monitor and track antibiotic resistance trends to guide effective treatment and prevention strategies.

Education and awareness

Patient education: Educate patients about the proper use of antibiotics, the importance of completing prescribed courses, and the dangers of antibiotic resistance.

Conclusion

Antibiotics are essential tools in modern medicine for treating bacterial infections and preventing the spread of disease. However, their benefits are increasingly threatened by antibiotic resistance, which can lead to more severe and difficult-to-treat infections. By understanding the types, uses, and risks of antibiotics, and by implementing effective strategies for their use and resistance prevention, we can help ensure that these vital medications continue to serve their purpose in protecting and improving human health. Ongoing education, responsible prescribing practices, and public awareness are crucial in managing the challenges associated with antibiotics and preserving their effectiveness for future generations.

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