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Study of the medicinal uses, adverse reactions, pharmacokinetics, and drug interactions of a few antibiotics

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Abstract

An antibiotic is a type of antimicrobial agent that works against bacteria. They might destroy bacteria or inhibit their growth. A specific number of anti-infection medications also have antiprotozoal activity. Antibiotics cannot be used to treat viruses. There includes a thorough discussion of the history, composition, mode of action, drug collaboration, clinical applications, doses, side effects, pharmacokinetics, and other aspects of antibiotics.

Introduction

The invention of antibiotics is commonly credited to Paul Ehrlich and Alexander Fleming. Ehrlich postulated a "magic bullet" that selectively targets only disease-causing bacteria and not the host based on the finding that aniline and other synthetic dyes, which first became accessible at that time, could stain some microbes but not others. According to Ehrlich, chemical substances might be developed that "exclusively exert their complete impact on the parasite contained within the organism." This idea inspired him to launch an extensive and effective screening programme (as we would call it now) in 1904 in an effort to find a cure for the then-endemic and essentially hopeless disease of syphilis. The spirochete Treponema pallidium causes this sexually transmitted disease, which was once treated with inorganic mercury salts. These salts were ineffective, nevertheless, and had serious negative effects. They produced hundreds of organ arsenic variants of the extremely lethal drug Atoxyl in his lab, along with bacteriologist Sahachiro Hata and chemist Alfred Bertheim, and tested them on rabbits with syphilis. Compound 606, the sixth in the 600th series of compounds tested, was found in 1909 and treated syphilis-infected rabbits while showing substantial promise for treating patients with venereal diseases in small human trials [1]. The medication, which had side effects and was marketed by Hoechst under the trade name Salvarsan, was a huge hit. It was also the most frequently prescribed medication until Neosalvarsan, a less toxic and more soluble alternative to penicillin, superseded it in the 1940s. Incredibly, the mechanism of action of this 100-year-old medicine is still unknown, albeit the controversy about its chemical makeup has finally been settled [2].

Fleming was also among the first to caution about the potential for penicillin resistance if it was administered too little or too soon during therapy . Antibiotic refers to a chemical that fights bacteria. Because they are the most significant type of antibacterial agent, antibiotics are frequently employed in the treatment and prevention of bacterial illnesses. Microorganisms may be either killed or prevented from growing. Only a few antibiotics also possess antiprotozoal qualities. Anti-toxins are ineffective against infections like the common cold or the flu; antibiotics do not work to inhibit the growth of viruses, but antiviral medications do.

Antibiotics-drug interactions: pharmacokinetics and probable interactions

antibiotics lactam Antibiotics in the oral -lactam family are very well absorbed. Its shared absorption process involves small peptides for entry into the enterocyte and escape through the basolateral membrane. The transport proteins for these antibiotics, which are in charge of their absorption, have been discovered [3]. To identify the proteins required for the proton-dependent absorption of -lactams, three different approaches were explored. A 127-kDa -lactam transporter was first discovered in rabbit intestinal brush boundary membranes using photoaffinity labelling, protein purification, and reconstitution.

Second, an immunological technique was used to identify a 120-kDa protein called HPT-1 in the apical membranes of human intestinal Caco-2 cells. The hpt-1 cDNA confers the ability to transport cephalexin and bestatin in a proton-dependent way. Finally, functional cloning of poly(A)+ RNA from rabbit intestine led to the discovery of the PepT1 protein, which cotransports protons with short peptides, -lactams, and angiotensin-converting enzyme inhibitors. The kidney also contains PepT2, a transporter that is quite similar to PepT1 [4]. The serum half-life (t1/2) of the vast majority of beta-lactams is 1-2 hours. In patients with normal renal function, ceftriaxone has a half-life of 8 to 10 hours while ceftazidime has a half-life of 4-6 hours. Because beta-lactams are very tolerable, they can be eliminated quickly and with minimal impact on dosage schedules. Penicillins and cephalosporins are excreted by glial filtration and different degrees of active transport across the epithelial cells of the renal tubuli and hepatobiliary system. Active transport mechanisms also account for the low levels of beta-lactam antibiotics in the cerebrospinal fluid. Otherwise, unspecialized tissues are easily penetrated by these substances. According to ratios of areas under concentration curves, the concentrations of amoxicillin and ampicillin, two drugs with poor serum protein binding, are 50–80% of serum levels in human peripheral lymph. It seems that the pace at which the antibiotic enters extravascular foci is mostly inhibited by the serum protein binding. For instance, temocillin, whose serum egg whites are restricted to around 85%, establishes levels in the peripheral lymph that are between 50% and 60% of those in the serum. Aminoglycosides with penicillins: This might be as a result of higher lipid solubility being accompanied with higher protein binding, which are two opposing factors when it comes to diffusion through bodily

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barriers [5]. 10 Due to an in vitro interaction between penicillins and aminoglycoside antibiotics, if these antibiotics are combined in the same bottle, there will be a considerable reduction in aminoglycoside antibacterial activity.

Anti-toxins using Tetacycline

When bioavailability is managed by intramuscular infusion, it is less than 40%, 100% intravenously, and 60-80% orally (fasting grown-ups). When taken with food or milk, tetracycline oral formulations are up to 50% less likely to be absorbed by the GI system. Assimilation can range from 0% to almost 90%, although for the most majority of agents, it is between 25% and 60% [6]. After oral dosing, serum concentrations progressively increase and the drug is absorbed via the stomach, duodenum, and small intestine. The Cmax (mg/L), which varies depending on the dose, usually ranges between 1 and 5 mg/L. Except for demeclocycline, whose Cmax is delayed until 4 to 6 hours, the tmax is between 2 and 4 hours . All tetracyclines considerably decrease absorption by forming insoluble compounds with calcium, magnesium, iron, and aluminium [7-9]. Whether illness has an impact on how these medications are absorbed is unknown. When tetracycline is taken with meals that are rich in protein, fat, and carbohydrates, its absorption is reduced by around 50%. Considering that the total volume of distribution (V) for these drugs is 100-130 L, or 1.3-1.7 L/kg, these statistics imply that there is some concentration in the tissues. Yet, most data on tissue entrance is of poor quality, making it difficult to make certain judgements regarding their relative dispersion. Proteins bind in different ways. None of these compounds are subject to metabolism, except for tetracycline, which excretes 5% of its contents as the metabolite epitetracycline .

Unchanged medications are eliminated through the biliary and renal pathways. Except for chlortetracycline, most medicines are associated with glomerular filtration through renal elimination (CLR). Rolitetracycline is believed to be swiftly eliminated by the kidney, with 50% of the drug being excreted in the urine. More than 40% of medications are eliminated in the faeces after biliary clearance, and most pharmaceuticals undergo some enterohepatic circulation. Tetracycline interacts with magnesium-containing antacids, aluminum-containing antacids, calcium- or sodium-bicarbonate-containing supplements, zinc-, iron-, and magnesium-containing laxatives, resulting in diminished efficacy. Antibiotics should not be taken during pregnancy due to the risk of hepatotoxicity in the mother, the potential for extremely long-lasting tooth discoloration in the hatchling (yellow or brown by all accounts), and the impairment of fetal long bone growth. Tetracyclines and penicillins are both bacteriostatic drugs, therefore using them together will inhibit the latter from working .

Lipopeptide-containing antibiotics Lipopeptides must be delivered parenterally since they cannot be absorbed by the digestive system. Due to their strong binding to plasma proteins (approximately 90%) and negative charge at pH, lipopeptides have a low volume of distribution (0.1 L/kg in healthy people). They are mostly eliminated by the kidneys, with around half of it passing through the urine unchanged. When used with lipopeptides like Daptomycin, ibuprofen increases the risk of renal debilitation. Simvastatin, fluvastatin, atorvastatin, lovastatin, pitavastatin, pravastatin, rosuvastatin, and other drugs have a mildly negative interaction with daptomycin.

Conclusion

Antibiotics like bactericidal and bacteriostatic drugs are frequently used to treat various types of bacterial infections. Because of their chemical makeup, mode of action, side effects, and dose fixation, antibiotics should only be taken after consulting a licensed medical professional. Self-medication with antibiotics has the potential to be dangerous. Antibiotics have the ability to save lives in the end.

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