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Perspective

Types and Mechanism of Penicillin

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DESCRIPTION

Today, various forms of penicillin's are manufactured to treat bacterial infections. Penicillin's are commonly prescribed by doctors to treat pneumonia, syphilis, and meningitis, among other bacterial diseases. Penicillin's are antibiotics that belong to a larger family known as beta-lactam antibiotics. These antibiotics feature a beta-lactam ring in their chemical structure and exhibit potent antibacterial action against a wide range of bacteria types. They are given orally as tablets, capsules, liquid solutions, and intravenous injections. Penicillin acts by preventing bacteria from maintaining their cell walls. The bacterial cell wall is an important component made of peptidoglycan, a substance that helps the cells keep their shape. Bacteria cannot survive without their cell wall, which results in cell bursting (lysis) and cell death. Penicillin's are classified as bactericidal antibiotics since they directly destroy bacteria. Penicillin's can target different types of bacteria, and are typically efficient against gram-positive bacteria.

The four-membered beta-lactam ring is unique to penicillin and other beta-lactam antibiotics. Penicillin kills bacteria by preventing cross-linking and inhibiting cell wall formation by attaching the beta-lactam ring to DD-transpeptidase. A bacterial cell that lacks a cell wall is vulnerable to outside water and molecular pressures, leading it to die quickly. Penicillin treatment causes bacterial cell death but has no effect on human cells since they lack a cell wall. Penicillin is combined with a very unstable bicyclic system (4-membered Beta-Lactam) joined with a 5-membered thiazolidine. Penicillin has three chiral carbon atoms (c-3, c-5, and c-6) (chiral: A molecule or ion is chiral if any combination of rotation and translation cannot superimpose it on its mirror counterpart). In terms of naturally occurring and microbiologically active synthetic and semisynthetic penicillin, the three centers share the same absolute configuration. Carbon atoms with acyl amino groups (c-6) have an L configuration, whereas carbon atoms with carboxyl groups have a D-configuration. The acyl amino and carboxyl groups are trans to one another in the penam ring system. The absolute stereochemistry of penicillin is designated 3s:5R:6R.

Types of penicillin

Natural penicillin: Natural penicillin's include penicillin G, penicillin V. These antibiotics were among the first to be used to treat bacterial infections. They kill bacteria by blocking the cell wall formation. They are most efficient against gram-positive and certain gram-negative bacteria. Penicillin G and penicillin V are examples of natural penicillin's.

Aminopenicillin: Aminopenicillin's, like natural penicillin's, work by preventing the production of bacterial cell walls. They are more effective against a broader spectrum of microorganisms. Aminopenicillin's are effective against gram-positive bacteria, enterococci, and several gram-negative bacilli, including *H. influenzae* and *E. coli*. To make aminopenicillin's more effective against particular bacteria, they are usually coupled with a beta-lactamase inhibitor such as clavulanate or sulbactam. Aminopenicillin's include ampicillin, amoxicillin, and hetacillin as examples.

Broad-spectrum (antipseudomonal) penicillin: Broad-spectrum penicillin's, often known as antipseudomonal penicillin's, are a class of penicillin antibiotics that have the same antibacterial activity as aminopenicillin's but also have an action against Pseudomonas and select strains of *Enterobacter* and *Serratia* species. Antipseudomonal penicillin's, like other penicillin's, are usually administered alongside beta-lactamase inhibitors. To treat infections caused by *Pseudomonas aeruginosa*, antipseudomonal penicillin's are usually combined with another antibiotic class known as aminoglycosides. Piperacillin, carbenicillin, ticarcillin, and mezlocillin are examples of antipseudomonal penicillin's.

Beta-lactamase inhibitors: Beta-lactamase, an enzyme that deactivates beta-lactam antibiotics, is produced by certain bacteria. Beta-lactamase inhibitors are antibiotics that combat bacterial resistance to beta-lactams. They are often used in conjunction with a penicillin antibiotic to keep it from deteriorating, hence enhancing the antibiotic's efficacy. When administered alone, beta-lactamase inhibitors have no bactericidal action. Clavulanate (or clavulanic acid), sulbactam, and tazobactam are a few examples.

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Penicillinase-resistant penicillin's: Penicillinase-resistant penicillin's are a kind of penicillin that is used to treat methicillin-sensitive *staphylococcus aureus* that produces penicillinase. They can also be used to treat *streptococcus pneumoniae*, group A streptococcal infections, and certain methicillin-sensitive staphylococcal infections. Resistant strains of these bacteria generate penicillinase, an enzyme that deactivates penicillin antibiotics. Oxacillin, dicloxacillin, nafcillin, flucloxacillin, and cloxacillin are examples of penicillinase-resistant penicillin's.

CONCLUSION

Generic versions of several penicillin medications are available. Generic antibiotics are typically less expensive than brand-name antibiotics while being similarly effective. Most Medicare and insurance policies cover penicillin medicines as well. In individuals with heart or renal diseases, penicillin's such as ticarcillin and carbenicillin need to be avoided or monitored. These penicillin's may induce a rise in salt levels in the blood. Around 10% of children have been diagnosed with a penicillin allergy, albeit the majority of these children do not have a real allergy to the drug. For example, gastrointestinal symptoms are not considered allergies.