

injection into a muscle or as an IV infusion. This drug leads to nephrotoxicity and ototoxicity.

Streptomycin

Stripper-mouse

Streptomycin was the first aminoglycoside discovered and is used for mycobacterium tuberculosis infections. Streptomycin still can be used for TB, but it is infrequent because of the bacteria's resistance and the availability of newer, more effective TB drugs. It is given via injection into a muscle, usually the thigh or upper buttocks. This drug has the side effects of nephrotoxicity and ototoxicity.

Mechanism of Action

Bactericidal

Bacteria-sliders

Unlike bacteriostatic agents, which simply stop bacteria from reproducing, bactericidal agents actually cause bacterial cell death. Aminoglycosides bind to the 30S ribosomal subunit of bacteria and cause misreading of mRNA during protein synthesis. The production of nonfunctional proteins disrupts cell membrane integrity and key metabolic processes. They do not directly affect DNA replication, but inhibiting proper protein synthesis impairs bacterial growth and division. A higher concentration of medication leads to quicker eradication of the infection.

Requires Oxygen for Uptake

O₂-tank Uptake-tube

Aminoglycosides require oxygen for uptake because their entry mechanism into bacterial cells depends on an energy-dependent transport system known as "energy-dependent phase I." This system uses the bacterial electron transport chain and requires oxygen to generate the proton motive force. This force is needed for the active transport of aminoglycosides across the inner bacterial membrane.

Synergistic with β -lactam Antibiotics

(B lac) Black Beta-fish

Aminoglycosides are synergistic with β -lactam antibiotics. This synergy occurs because β -lactams disrupt the bacterial cell wall, enhancing aminoglycoside penetration. This combination is especially effective in treating serious infections like endocarditis caused by Gram-positive organisms such as Enterococcus.

Indications

Severe Gram-Negative Infections

Severed Gram-cracker Negative-devil

Aminoglycosides are typically used to treat serious infections caused by aerobic gram-negative bacilli. The most frequent use of these antibiotics is empiric therapy for serious infections, including septicemia, complicated intraabdominal infections, UTIs, and nosocomial upper respiratory tract infections.

Bowel Surgery Prep

Bowel-bowl Surgery

The aminoglycoside Neomycin is often used for bowel surgery prep to suppress bowel flora and decrease the risk of infection after surgery. Remember, aminoglycosides are not absorbed well into the body through the GI tract, so the risk of side effects is much lower when using them for bowel surgery preparation.

MECHANISM OF RESISTANCE

Bacterial Transferases

Bacteria Transformer

Bacterial transferases inactivate aminoglycosides by acetylation, phosphorylation, or adenylation.