

Tobramycin

Cobra-mouse

This is another aminoglycoside antibiotic used for gram negative infections. It is better than gentamicin when it comes to treating pseudomonal infections of the lung. It also cannot be given orally, but has a special application as an ophthalmic solution (Tobrex) for bacterial conjunctivitis. Just like other aminoglycosides, tobramycin also causes ototoxicity and nephrotoxicity.

Streptomycin

Stripper-mouse

This was the first aminoglycoside discovered and was used for Mycobacterium tuberculosis infections. This antibiotic is now occasionally used for endocarditis, Yersinia pestis infestation and tuberculosis. Just like other aminoglycosides, streptomycin also causes ototoxicity and nephrotoxicity.

Mechanism of Action

Bactericidal

Bacteria-sliders

Unlike bacteriostatic agents, which simply stop bacteria from reproducing, bactericidal agents actually cause active bacterial cell death.

Inhibit Formation of Initiation Complex

Inhibiting-chains on Initiation-engine

Aminoglycosides bind to the 30S prokaryotic ribosomal subunit and inhibit bacterial protein synthesis. This is performed by inhibiting formation of the initiation complex required to translate bacterial mRNA.

Cause Misreading of mRNA

Misread Mail-(RNA)-rhino

Aminoglycosides bind to the 30S prokaryotic ribosomal subunit and are known to interfere with the proofreading process, increasing the error rate during synthesis and misreading of bacterial mRNA. This commonly leads to premature termination of protein synthesis.

Require O₂ for Uptake

Oxygen-mask from O₂-tank

Aminoglycosides require oxygen for uptake into the bacterial organism. As such, these antibiotics are ineffective against anaerobes, which do not require oxygen for proliferation.

Resistance

Resistance by Transferase Enzymes

Tied-up by Transformer wearing Resistance-bandana

Enzymatic modification by transferase enzymes is the most common mechanism of aminoglycoside resistance. The genes encoding for these modifying enzymes are typically found on plasmids and transposons. There are three types of aminoglycoside modifying enzymes, including acetyltransferases, phosphotransferases and adenylyltransferases.

Acetylation

A-seagull

Acetylation refers to the transfer of an acetyl group on an amino group and this form of enzymatic modification can lead to aminoglycoside resistance.

Phosphorylation

Phosphate-P

Phosphotransferases catalyze ATP-dependent phosphorylation of a hydroxyl group and this form of enzymatic modification can lead to aminoglycoside resistance.

Adenylation

Add (+) signs

Adenyltransferases catalyze ATP-dependent adenylation of hydroxyl groups and this form of enzymatic modification can lead to aminoglycoside resistance.

Indications

Gram-Negative Rod Infections

Graham-cracker Negative-devil-with-rod

Aminoglycosides are typically used for aerobic gram-negative rod infections, including *Pseudomonas* and *Enterobacter*. The most frequent use of these antibiotics include empiric therapy for serious infections, including septicemia, complicated intra-abdominal infections, UTIs, and nosocomial URIs.

Synergistic with B-Lactam Antibiotics

(B lac) Black Beta-fish

Aminoglycosides are sometimes used in conjunction with beta-lactam antibiotics in streptococcal infections due to their synergistic effects, especially in the treatment of endocarditis. One of the most frequently used combinations is ampicillin and gentamicin.

Side Effects

Nephrotoxicity Especially When Used with Cephalosporins

Kidney with Toxic-green-glow held by Chef-spore-head

Cephalosporins and aminoglycosides demonstrate a synergistic nephrotoxic interaction when used in conjunction. Therefore, this drug combination should be avoided unless clinically required and kidney function should be monitored throughout the treatment course.

Ototoxicity Especially When Used with Loop Diuretics

Ear with Toxic-green-glow from Launching Loop-hen Die-rocket

Aminoglycosides and loop diuretics, like furosemide, demonstrate a synergistic ototoxic interaction when used in conjunction. Therefore, this drug combination should be avoided when possible.

Teratogen

Tarantula-gem

Aminoglycosides are known teratogens and are in pregnancy category D, meaning there is positive evidence of human fetal risk based on data from studies in humans. Teratogens are agents that cause a defect or malformation in the development of the embryo or fetus. Aminoglycosides are especially associated with causing hearing deficits.