

Aminoglycosides Mechanism of Action (MOA): Aminoglycosides bind irreversibly to the 30S ribosomal subunit of bacterial ribosomes, leading to:

- Inhibition of protein synthesis.
- Misreading of mRNA, causing the production of nonfunctional or toxic proteins.
- Disruption of bacterial membrane integrity, ultimately leading to cell death. This bactericidal activity is concentration-dependent.

Classification: Aminoglycosides are a class of bactericidal antibiotics. Examples include:

- Gentamicin
- Tobramycin
- Amikacin
- Streptomycin
- Neomycin

Spectrum of Activity: Aminoglycosides are primarily effective against:

- Gram-negative aerobes: *E. coli*, *Klebsiella* spp., *Pseudomonas aeruginosa*, *Proteus* spp.
- Limited activity against Gram-positive organisms, but often used synergistically with beta-lactams or vancomycin for infections caused by *Enterococcus* spp. or *Staphylococcus aureus*.
- Ineffective against anaerobic bacteria due to oxygen-dependent uptake.

Dosing: Dosing varies based on the specific drug, indication, and patient factors (e.g., renal function). Typical approaches include:

- Gentamicin/Tobramycin:
 - Conventional dosing: 1–2 mg/kg every 8 hours.
 - Once-daily dosing: 5–7 mg/kg once daily.
- Amikacin:
 - 15–20 mg/kg once daily.
 - Adjustments for renal impairment are critical due to nephrotoxicity risks.

Therapeutic drug monitoring (TDM) is often employed to optimize efficacy and minimize toxicity.

Adverse Effects: Aminoglycosides are associated with significant toxicities, particularly with prolonged use or high doses:

- Nephrotoxicity: Reversible damage to renal tubules.
- Ototoxicity: Irreversible hearing loss or vestibular dysfunction.
- Neuromuscular blockade: Rare but can lead to respiratory paralysis, particularly in patients with underlying neuromuscular disorders or concurrent use of neuromuscular blockers.
- Hypersensitivity reactions: Rare.