amikacin (am-i-kay-sin)

**Classification**
- Therapeutic: anti-infective
- Pharmacologic: aminoglycosides

**Pregnancy Category D**

**Indications**
- IM, IV: Treatment of serious infections for which treatment with less toxic anti-infectives is contraindicated or known to be ineffective. Administer with caution in the management of SSI infections. Bolus or aerosol administration for the prevention of serious pneumonia in high-risk populations.

**Action**
- Inhibits protein synthesis in bacteria at the level of the 30S ribosome. Resists the action of enzymes known to inactivate other aminoglycosides.

**Therapeutic Effects:**
- Bactericidal action against susceptible bacteria.

**Spectrum:**
- Notable for activity against:
  - Pseudomonas aeruginosa
  - Klebsiella pneumoniae
  - Escherichia coli
  - Proteus
  - Providencia
  - Enterobacter
  - Citrobacter freundii
  - Serratia
  - Acinetobacter
- Amikacin is also active against Staphylococci (including methicillin-resistant strains). Acts synergistically with beta-lactam anti-infectives against gram-negative organisms. In the treatment of enterococcal infections, synergy with a penicillin is required.

**Pharmacokinetics**
- **Absorption:** Poorly absorbed from the GI tract. Well absorbed after IM administration; IV administration results in complete bioavailability.
- **Distribution:** Widely distributed throughout extracellular fluid. Crosses the placenta; small amounts enter breast milk. Poor penetration into CSF (q when meninges inflamed).
- **Metabolism and Excretion:** Excretion is mainly (90%) renal; minimal amounts are metabolized by the liver.
- **Half-life:** Infants: 7 days; Children: 1.6–2.5 hr; Adolescents: 0.5–2.5 hr; Adults: 2–3 hr (q in renal impairment, q in patients with burns).

**Indications/Precautions**
- **Contraindicated in:** Hypersensitivity to amikacin, other aminoglycosides, or bi sulfites.
- **Use Cautiously in:** Renal or auditory impairment of any kind (dosage adjustments necessary—blood level monitoring useful in preventing ototoxicity and nephrotoxicity); Neuromuscular diseases such as myasthenia gravis or Parkinson’s disease; Patients with burns (may require larger, more frequent doses); OB: May cause fetal nephrotoxicity or deafness; Lactation: Safety not established; Pedi: Neonates have prolonged half-life due to renal immaturity; Geri: Caution necessary due to age-related renal impairment, may be difficult to assess vestibular and auditory function in geriatric or debilitated patients.

**Adverse Reactions/Side Effects**
- **CNS:** Vertigo.
- **EENT:** Ototoxicity (vestibular and cochlear).
- **GU:** Nephrotoxicity.
- **Neuro:** Enhanced neuromuscular blockade.
- **Resp:** Apnea.
- **Misc:** Hypersensitivity reactions.

**Interactions**
- **Drug-Drug:** Inactivated by extended-spectrum penicillins when coadministered to patients with renal insufficiency. May potentiate effects of inhalation anesthetics or neuromuscular blockers. May increase incidence of nephrotoxicity with other nephrotoxic drugs, such as amphotericin, vancomycin, aminoglycosides, or cephalosporins.

**Route/Dosage**
- **IM, IV (Adults and Children):** 15 mg/kg/day divided q 8–12 hr (not to exceed 1.5 g/day).
- **Mycobacterium avium complex infection:** 7.5–15 mg/kg/day divided q 12–24 hr.
- **IM, IV (Neonates):** Loading dose—30 mg/kg; Maintenance dose—7.5 mg/kg q 12 hr.

**Renal Impairment**
- **IM, IV (Adults):** Loading dose—7.5 mg/kg; further dosing based on serum levels.
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NURSING IMPLICATIONS

Assessment

- Assess for infection: initial signs, wound appearance, sputum, urine, and stool. Worsening beginning and throughout therapy.
- Obtain specimens for culture and sensitivity before initiating therapy. First dose may be given before receiving results.
- Evaluate eighth cranial nerve function by audiometry before and throughout therapy. Hearing loss is usually in the high-frequency range. Prompt recognition and intervention are essential in preventing permanent damage. Also monitor for vestibular dysfunction (vertigo, ataxia, nausea, vomiting). Eighth cranial nerve dysfunction is associated with persistently elevated peak amikacin levels. Tinnitus should be discontinued if ototoxic hearing loss occurs.
- Monitor intake and output and daily weight to assess hydration status and renal function.
- Assess for signs of superinfection (fever, upper respiratory infection, vaginal itching or discharge, increasing malaise, diarrhea).

Lab Test Considerations:

- Monitor renal function by urinalysis, specific gravity, BUN, creatinine, and CCr before and during therapy. May cause q BUN and creatinine concentrations.

Toxicity and Overdose:

- Monitor therapeutic blood levels periodically during therapy. Timing of blood levels is important in interpreting results. Draw blood for peak levels 1 hr after IM injection and 30 min after a 30-min IV infusion is completed. Trough levels should be drawn just before next dose. Peak level range 20–30 mcg/mL; trough level 10 mcg/mL.
- Unlabeled q 24 h dosing—trough level 1 mcg/mL.

Potential Nursing Diagnoses

- Risk for infection (Indications)
- Disturbed sensory perception (auditory) (Side Effects)

Implementation

- Keep patient well hydrated (1500–2000 mL/day) during therapy.
- IV: If aminoglycosides and penicillins or cephalosporins must be administered concurrently, administer in separate sites, at least 1 hr apart.

IV Administration

- pH: 5.5–6.5
- Intermittent Infusion: Dilute with D10W, D5W, 0.9% NaCl, dextrose/saline combination, or LR. Solution may be pale yellow without decreased potency. Stable for 24 hr at room temperature. Concentration: 10 mg/mL. Rate: Infuse over 30–60 min.
- Storage Incompatibility: hyporn.
amikacin


- Additive Incompatibility: Manufacturer does not recommend admixing.

Patient/Family Teaching

- Instruct patient to report signs of hypersensitivity, tinnitus, vertigo, muscle weakness/twitching, feeling of fullness in the head, or hearing loss.

Evaluation/Desired Outcomes

- Resolution of the signs and symptoms of infection. If no response is seen within 3–5 days, new cultures should be obtained.

Why was this drug prescribed for your patient?