Aminoglycoside Dosing Guidelines for Adults

Necessary Patient Information for Dosing

- **Ideal body weight (IBW)**
  - Use of IBW is recommended for aminoglycoside dosing unless patient meets criteria for utilization of ABW or AdBW (below)
    - Males = 50 + 2.3 x (height (in) – 60)
    - Females = 45.5 + 2.3 x (height (in) – 60)
- **Actual body weight (ABW)**
  - Use of ABW is recommended for aminoglycoside dosing IF ABW < IBW
- **Adjusted body weight (AdBW)**
  - Use of AdBW is recommended for aminoglycoside dosing IF ABW > 130% IBW
    - AdBW = IBW + 0.4(ABW – IBW)
- **CrCl** – aminoglycosides are exclusively renally cleared and must be renally adjusted
  - CrCl = \((140 - \text{age}) \times (\text{wt in kg}) \times 0.85 \) if female
  - 72 x SCr
- **Indication** - What are the aminoglycosides being used for?
  - Gram positive synergy?
  - Serious gram negative infection?
    - Extended interval vs convention dosing

Gram Positive Synergy in Enterococcal or Staphylococcal Infections

- Only gentamicin is routinely utilized for this indication (below recommendations reflect gentamicin dosing and monitoring)
  - Streptomycin may be utilized for this indication but ID consult is highly recommended
- Use conventional dosing of **1 mg/kg every 8 hours** (always use IBW)
- In elderly and patients with renal impairment consider increasing interval to every 12 hours
- Peaks are not routinely recommended, but if taken, target peak should be **3-5 mcg/mL**
- Routinely recommended: Target trough < **1 mcg/mL**
- Check trough +/- peak with **3rd dose**
  - Once peak in therapeutic range it is not necessary to continue monitoring peaks
  - If trough > 1 mcg/mL increase interval to every 12 hours then every 24 hours if necessary
    - Goal of monitoring is to **avoid toxicity** which is associated with troughs > 1 mcg/mL
- Check trough twice a week if stable and more often if clinically indicated or with changing renal function
Serious Gram Negative Infections

Extended Interval Dosing (CrCl ≥ 30 mL/min)

- Initial Dosing
  - Gentamicin/tobramycin: 5 – 7 mg/kg (IBW, ABW or AdBW)
    - Consider 5 mg/kg in elderly and those with marginal renal function or treatment of urinary tract infection
    - Consider 7 mg/kg in young patients with good clearance and those with known multidrug resistant organisms
    - Consider infectious diseases consult or contacting clinical pharmacist for morbidly obese patients
    - Round to the nearest 10 mg
  - Amikacin: 15-20 mg/kg (IBW, ABW or AdBW)
    - Round to the nearest 25 mg
- Monitoring
  - Therapeutic drug monitoring of extended interval aminoglycosides can be done by EITHER utilizing a nomogram or by troughs
  - Nomogram
    - Order random level 8 hours post infusion
    - Plot serum concentration and time of level on nomogram (below) to determine interval
    - Wherever this point lies is the recommended dosing interval
    - If the serum level is above the q48h interval, convert the patient to conventional dosing (see below)
    - To use nomogram for amikacin, divide the actual serum level of amikacin in half, and then apply it to the nomogram
Troughs

- Order a trough 24 hours after dose
- Redose aminoglycoside if level ≤ 1 mcg/mL for gent/tobra or ≤ 5 mg/mL for amikacin
- If serum concentrations are above these thresholds, repeat random levels and redose when levels fall below above stated serum concentration
- Dosing interval can be determined when level falls below above stated serum concentration
- **NOTE:** If it takes > 48 hours to fall below stated levels, convert to conventional dosing (below)

Nomogram vs Troughs

- Some prefer utilizing the nomogram as it is easy to use and immediately gives you a dosing interval
- Some prefer utilizing troughs as the timing of 8 hour levels may be difficult but troughs may not always give you an immediate dosing interval
- No matter which method is chosen, levels should be followed with every dose in patients with changing renal function and at least twice weekly in stable patients
- Peaks are not routinely recommended because of the high doses given with this dosing regimen
  - Peaks may be utilized in special circumstances such as patients with severely altered pharmacokinetics

**Conventional Dosing (CrCl < 30 mL/min)**

- **Initial Dosing**
  - Septic shock dosing
    - Gentamicin/Tobramycin: 3 mg/kg (IBW, ABW or AdBW)
    - Amikacin: 7.5 mg/kg (IBW, ABW or AdBW)

- **Monitoring**
  - Order peak level **30 min post infusion** of the FIRST dose
    - **Goal**
      - Gent/tobra: 8-10 mcg/mL
      - Amikacin: 25-30 mcg/mL
    - Peaks correlate with **EFFICACY**
    - Use the peak to calculate your patient’s volume of distribution (Vd)
      - Vd (L) = dose (mg) / peak (mcg/L)
  - **Was peak level at goal?** (Gent/tobra = 8 – 10 mcg/mL, Amikacin = 25 – 30 mcg/mL)
    - **If Yes...**
      - Continue same dose
      - Empiric dosing interval = **Q24h** for CrCl 10-30 mL/min, **Q48h** for CrCl < 10 mL/min
      - Check trough to make sure ≤ 2 mcg/mL for gent/tobra and ≤ 10 mcg/mL for amikacin
      - If renal function unstable, anuria, or other clinical situations, check level every 24 hours and re-dose when level falls below stated level
If No…
- Calculate new dose – **New dose = Vd x desired peak**
- Dosing interval = **Q24h (CrCL 10-30 mL/min), Q48h (CrCL < 10 mL/min)**
- Check trough to make sure ≤ **2 mcg/mL for gent/tobra and ≤ 10 mcg/mL for amikacin**
- If renal function unstable, anuria, or other clinical situations, check level every 24 hours and re-dose when level is ≤ 2 mcg/mL
  - Continue monitoring peaks and troughs until patient on a stable regimen
  - Once on stable regimen monitor peaks and troughs twice a week or more often if clinically indicated or renal function changes

### Indication Specific Dosing

**Ob/gyn or Urology pts with any CrCl – Conventional dosing**
- Initial dose: **1-2.5 mg/kg (IBW, ABW or AdBW) every 8 hours**
  - Renal adjustment:
    - ≥ 60 mL/min : every 8 hours
    - 40 – 60 mL/min: every 12 hours
    - 20 – 40 mL/min: every 24 hours
    - < 20 mL/min: dose by levels
- Monitoring
  - Use similar dose adjustments as with above conventional dosing
  - Peak and trough with 3rd dose
    - Target peak (30 min after infusion): **6-8 mcg/mL** (8-10 mcg/mL in serious infections)
    - Target trough (30 min prior to next dose): < **2 mcg/mL**

### Hemodialysis Dosing

- **Gent/tobra = 1.5-2 mg/kg after every HD session**
- **Amikacin = 5-7.5 mg/kg after every HD session**
- Aminoglycosides are removed by dialysis
- Check peaks for efficacy and troughs **2 hours post dialysis** periodically to avoid accumulation
  - Pre-dialysis levels can also be used in place of troughs to assess for accumulation
- For patients on CRRT consider infectious diseases consult

**Reference:**