Drug Dosing in Special Population

Measurement and Estimation of Creatinine Clearance

** Glomerular filtration rate (GFR) can be estimated using the modified Modification of Diet in Renal Disease (MDRD) equation:

GFR (in mL/min / 1.73 m^2) = 186. $S_{Cr}^{-1.154}$. $Age^{-0.203}$. (0.742, if female). (1.21, if African-American).

** Creatinine clearance rates can be measured by collecting urine for a specified period and collecting a blood sample for determination of serum creatinine at the midpoint of the concurrent urine collection time:

CrCl (in mL/min) = (U_{Cr} . V_{urine}) / (S_{Cr} . T)

- U_{Cr} is the urine creatinine concentration in mg/dL
- V_{urine} is the volume of urine collected in mL
- S_{Cr} is the serum creatinine collected at the midpoint of the urine collection in mg/dL
- T is the time in minutes of the urine collection.

The most widely used of these formulas for adults aged 18 years and older is the method suggested by **Cockcroft and Gault

For males $CrCl_{est}$ = [(140 − age) BW]/ (72 . SCr)

For females $CrCl_{est}$ = [0.85(140 − age)BW] / (72 . SCr)

- $CrCl_{est}$ is estimated creatinine clearance in mL/min
- Age is in years
- BW is body weight in kg
- SCr is serum creatinine in mg/dL.

The Cockcroft-Gault method should only be used in:

- Patients ≥18 years old, actual weight within 30% of their ideal body weight
  - ❖ IBWmales (in kg) = 50 + 2.3(Ht − 60)
  - ❖ IBWfemales (in kg) = 45 + 2.3(Ht − 60) where Ht is height in inches.
- Stable serum creatinine concentrations.

If serum **creatinine values are not stable, but increasing or decreasing in a patient, the Cockcroft-Gault equation **cannot** be used to estimate creatinine clearance.

In this case, an alternate method must be used which was suggested by **Jelliffe and Jelliffe.**

Ess_{male} = IBW[29.3 − (0.203 . age)]

Ess_{female} = IBW[25.1 − (0.175 . age)]

- Ess is the excretion of creatinine
- IBW is ideal body weight in kilograms
- Age is in years.

$$Ess_{corrected} = Ess[1.035 - (0.0337 \cdot Scr_{ave})]$$

$$E = Ess_{corrected} - \frac{[4IBW(Scr_2 - Scr_1)]}{\Delta t}$$

$$CrCl\ (in\ mL/min/1.73m^2) = E/(14.4 \cdot Scr_{ave})$$

- Scr_{ave} is the average of the two serum creatinine determinations in mg/dL
- Scr_1 is the first serum creatinine and Scr_2 is the second serum creatinine both in mg/dL
- Δt is the time that expired between the measurement of Scr_1 and Scr_2 in minutes.

** If patients are not within 30% of their ideal body weight, other methods to estimate creatinine clearance should be used. A specific method suggested by **Salazar and Corcoran** for estimating creatinine clearance for **obese patients** has been shown to be generally superior:

$$CrCl_{est(males)} = \frac{(137 - age)[(0.285 \cdot Wt) + (12.1 \cdot Ht^2)]}{(51 \cdot S_{Cr})}$$

$$CrCl_{est(females)} = \frac{(146 - age)[(0.287 \cdot Wt) + (9.74 \cdot Ht^2)]}{(60 \cdot S_{Cr})}$$

- Age is in years
- Wt is weight in kg
- Ht is height in m
- S_{Cr} is serum creatinine in mg/dL.

**Methods to estimate creatinine clearance for children and young adults are also available according to their age:

- Age 0–1 year, $CrCl_{est}$ (in mL/min / 1.73 m2) = (0.45 · Ht) / SCr;
- Age 1–20 years, $CrCl_{est}$ (in mL/min / 1.73 m2) = (0.55 · Ht)/SCr
- Ht is in cm and SCr is in mg/dL.

(Note: This summery is designed only for the lab; it never designed for any exam)

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