2.3. Estimating Creatinine Clearance

Solutions

1. On average, women have a lower percent of body weight that is muscle than do men of the same weight. It is arbitrary and there are women with more or less muscle mass than average. Looking at the patient can help determine if further adjustment in the prediction might be warranted.

2. A. Creatinine clearance is an estimate of glomerular filtration rate (GFR).

   B. CrCl overestimates GFR because approximately 20% of the amount in the urine is from tubular secretion. This overestimate is more pronounced at low CrCl because secretion is not as affected by reduced renal function as GFR.

3. B. On average, the elderly have a smaller percent of body mass that is muscle. Although they often also have reduced renal function and may have reduced hepatic function, these are not the reasons why clinicians have suggested adjusting the S_{Cr} upward to be more conservative with dosing estimates.

4. A. The muscular individual. Muscular patients would have increased production of creatinine from the additional muscle. Thus, for the same S_{Cr} a muscular individual would have to be clearing the creatinine at a faster rate.

5. Because the S_{Cr} is impacted by dialysis more than residual renal function, using the S_{Cr} to determine any residual CrCl by the kidneys would not be appropriate. If the patient is producing urine that would be an indicator of some residual renal function.

6. The S_{Cr} in a newborn is more representative of the mother's S_{Cr} and should not be used to estimate CrCl for the first couple of days, although with subsequent measurements an early S_{Cr} can be used to determine whether S_{Cr} is trending upward or downward over time. Urine output is probably a better measure of the baby's renal function early on.

7. A. **Cockcroft and Gault equation (males)**

$$CrCl = \frac{(140 - Age)(BW)}{(S_{Cr} \times 72)}$$

If IBW is used :

$$IBW = 50\ kg + 2.3(72 - 60)\ kg = 77.6\ kg$$

$$CrCl = \frac{(140 - 50)(77.6)}{(1\,mg/dL \times 72)} = \mathbf{97\ mL/min}$$

If ABW is used:

$$CrCl = \frac{(140 - 50)(110)}{(1\,mg/dL \times 72)} = \mathbf{137.5\ mL/min}$$

If BW_{adj} is used (with 0.4 factor):

$$BW_{adj} = IBW + 0.4(ABW - IBW)$$

$$= 77.6\ kg + 0.4(100 - 77.6)\ kg$$

$$= 86.6\ kg$$

$$CrCl = \frac{(140 - 50)(86.6)}{(1\,mg/dL \times 72)} = \mathbf{108.3\ mL/min}$$

B. **Salazar-Corcoran equation (for obese patients):**

$$CrCl = \frac{(137 - Age) \times [(0.285 \times BW) + (12.1 \times Ht^2)]}{(51 \times S_{Cr})}$$

where Ht is height in meters and BW = actual weight in kg.

Ht = 6 ft × 12 in/ft × 2.54 cm/in × 1 m/100 cm

= 1.829 m

$$CrCl = \frac{(137 - 50) \times [(0.285 \times 110) + (12.1 \times 1.829^2)]}{(51 \times 1)}$$

= 122.5 mL/min

C. The dilemma is to determine which of the weights, if any, best represent the patient's production of creatinine. For example, the muscular individual's body mass will have considerable muscle and extra weight (above IBW) will be largely creatinine-producing muscle mass. For the same serum creatinine as a normal person, he would have to be clearing the creatinine at a higher rate due to his higher input of creatinine into the blood-stream. It would probably be best to use ABW in this patient.

For the obese individual, his additional weight may largely be adipose tissue, which does not produce creatinine. The dilemma with him is whether the extra weight is mostly adipose tissue and IBW may predict actual CrCl best, or whether the extra weight is composed of some additional muscle to support that extra weight, where BW_{adj} might then be the best predictor.

8. A. A 50-kg, 5'8" tall, 65-year-old woman IBW = 45.5 kg + 2.3(68 – 60) kg = 63.9 kg. Since she weighs less than her IBW, actual body weight (ABW) should be used as it would be anticipated that muscle mass is decreased.

$$CrCl = \frac{(140 - Age)(BW)}{(S_{Cr} \times 72)} \times 0.85$$

$$CrCl = \frac{(140 - 65)(50)}{(1.4\,mg/dL \times 72)} \times 0.85$$

= 31.6 mL/min

B. A 110-kg, 5'8" tall, 80-year-old man

IBW = 50 kg + 2.3 (68 – 60) = 68.4 kg

BW_{adj} = 68.4 + 0.4(110 – 68.4) = 85.0 kg

$$CrCl = \frac{(140 - Age)(BW)}{(S_{Cr} \times 72)}$$

$$CrCl = \frac{(140 - 80)(85)}{(1.4\,mg/dL \times 72)}$$

= 50.6 mL/min