Case Study #4

Q1. For the following situations, indicate whether the drug is: filtered, reabsorbed, actively secreted, or reabsorbed through transporters ((Assume GFR is 130 mL min\(^{-1}\), urine flow is 1.5 ml min\(^{-1}\))

a). A drug with \(fu = 0.02\) and a \(Cl_{REN} = 20 \text{ mL min}^{-1}\)

\[
Cl_{REN} = 20 \text{ mL} > fu \times GFR = 2.6 \text{ mL min}^{-1} \Rightarrow \text{actively secreted}
\]

b). A drug with \(fu = 0.40\) and a \(Cl_{REN} = 52 \text{ mL min}^{-1}\)

\[
Cl_{REN} = 52 \text{ mL min}^{-1} = fu \times GFR = 52 \text{ mL min}^{-1} \Rightarrow \text{filtered}
\]

c). A drug with \(fu = 0.60\) and a \(Cl_{REN} = 0.9 \text{ mL min}^{-1}\)

\[
Cl_{REN} = 0.9 \text{ mL min}^{-1} < fu \times GFR = 98 \text{ mL min}^{-1} \Rightarrow \text{reabsorbed}
\]

\[
Cl_{REN} = 0.9 \text{ mL min}^{-1} = fu \times \text{urine flow} = 0.9 \text{ mL min}^{-1} \Rightarrow \text{reabsorbed through passive diffusion}
\]

d). A drug with \(fu = 1.0\) and a \(Cl_{REN} = 0.3 \text{ mL min}^{-1}\)

\[
Cl_{REN} = 0.3 \text{ mL min}^{-1} < fu \times GFR = 130 \text{ mL min}^{-1} \Rightarrow \text{reabsorbed}
\]

\[
Cl_{REN} = 0.3 \text{ mL min}^{-1} < fu \times \text{urine flow} = 1.5 \text{ mL min}^{-1} \Rightarrow \text{reabsorbed through transporters}
\]

Q2. A male patient is 5 ft 10 inches tall, 40 years old, and weights 80 kg. His serum creatinine is 1.5 mg/dl. Please estimate his GFR.

\[
IBW = 50 + 2.3 \times 10 = 73 \text{ kg}
\]

\[
TBW = 80 \text{ kg} < 120\% IBW \Rightarrow \text{not an obese patient} \therefore \text{use } IBW
\]

\[
GFR = CrCL = \frac{(140 - 40) \times 73}{72 \times 1.5} = 68 \text{ ml / min}
\]
Q3.  Mark each of the following statements True or False.

T F  The maximum value of renal clearance can not exceed the glomerula filtration rate.

T F  The renal clearance of a drug (as determined by filtration and reabsorption) always depends on the tissue binding of the drug.

T F  Drinking a lot of water (urine flow is doubled) will increase significantly the renal clearance of aminoglycosides.

T F  For an acidic drug with a pka of 1.0, adjustment of the urine pH within physiological ranges will significantly change the renal clearance.

T F  To determine the clearance of a drug, one needs to know whether the drug is a one or two compartment drug.

T F  Since creatinine is endogenous and predominantly eliminated by kidney, its clearance is a good estimation of renal active secretion.

T F  The larger the volume of distribution, the smaller the AUC of a given drug.

Q4.  Define the term linear pharmacokinetics.

- no saturation of binding sites (linear protein binding)
- no saturation of enzymes or transporters
- CL and Vd are independent of dose
- AUC and Ct changed proportionally with drug dose change