Chapter 2  Pharmacokinetic Principles

Case Study 1
After learning about pharmacokinetics, Rita realizes the complexity of the interactions between the body and medications. Today, an athlete expressed concern to Rita about the frequency of one of his medications. He was recently prescribed the antibiotic amoxicillin for an upper respiratory tract infection. The antibiotic needs to be taken 3 times per day, and the athlete is having trouble remembering to take it. He asks Rita why the antibiotic has to be taken multiple times per day. Use a medication reference to review the pharmacokinetics of amoxicillin. Based on the pharmacokinetic parameters, what factor would be most involved in the frequency of dosing?

Answer: Amoxicillin has a short half-life (around 1 hour), so it is cleared from the body relatively quickly. Therefore, the amoxicillin needs to be dosed multiple times per day to keep enough antibiotic in the body to fight the infection.

Case Study 2
One of the athletes Rita works with has recently been diagnosed with diabetes. The athlete will be using insulin to control his blood sugar and will be injecting the insulin subcutaneously in the thigh. Rita is concerned about the effects that exercise will have on the activity of the insulin and the patient’s blood sugar. Based on pharmacokinetic principles, what possible effect could exercise have on the insulin?

Answer: The blood flow to the site of injection is a critical factor in the absorption of medications injected subcutaneously or intramuscularly. Exercise will increase blood flow to skin and muscles. Therefore, exercise can increase the speed of absorption of drugs administered by subcutaneous injection. This could make the patient at risk for hypoglycemia (low blood sugar). Because of this, the athlete needs to be educated about the timing of insulin injection, food consumption, and exercise to keep things balanced.

Exam Questions

1. An athletic trainer wants to know how fast a particular medication will be eliminated from the body. An important pharmacokinetic parameter to review in this case would be the:
   a. Bioavailability.
   b. Half-life.
   c. Volume of distribution.
   d. Active transport.

2. If a medication is described as highly protein bound, this means that:
   a. A high percentage of drug is bound to the plasma protein albumin.
   b. The drug binds tightly to proteins at the site of action.
   c. The drug is combined with a protein to create a depot injection.
   d. Most of the drug is eliminated by hepatic metabolism.

3. The most common way for drugs to cross membranes is:
   a. Active transport.
   b. Facilitated diffusion.
   d. Transport through ion channels.
4. Exercise can increase the duration of action of some drugs that are metabolized by the liver because:
   a. Hepatic blood flow increases during exercise.
   b. **Hepatic blood flow decreases during exercise.**
   c. The volume of distribution increases during exercise.
   d. The volume of distribution decreases during exercise.

5. Medications that need to enter the central nervous system to reach their site of action should have what property?
   a. They should be water soluble so they are not substrates for cytochrome P450 enzymes.
   b. **They should be lipid soluble so they can cross the blood-brain barrier.**
   c. They should be water soluble so they have a high degree of protein binding.
   d. They should be lipid soluble so they will not distribute into fat tissue.

6. When medications are applied to the skin to produce a systemic effect, the delivery type is best referred to as:
   a. **Transdermal.**
   b. Topical.
   c. Intradermal.
   d. Subcutaneous.

7. What is an advantage of sublingual drug administration compared with other routes of administration?
   a. Sublingual drug administration can be used for the administration of drugs with low potency.
   b. Sublingual drug administration allows for less frequent drug administration because the drug slowly enters the blood.
   c. Sublingual drug administration has a high first-pass metabolism, making it ideal for administration of prodrugs.
   d. **Sublingual drug administration is faster due to the rich supply of blood vessels under the tongue.**

8. Which of the following oral dosage forms is a 2-phase system in which a solid is dispersed throughout a liquid?
   a. Elixir.
   b. Syrup.
   c. Emulsion.
   d. **Suspension.**

9. A company is formulating a generic version of a medication used to treat high blood pressure. To get this generic medication approved, the company has to prove that it is bioequivalent to the trade name product. Bioequivalence means that:
   a. The inactive ingredients in the 2 products are identical.
   b. **The extent and rate of absorption are similar for the 2 formulations.**
   c. The plasma concentration of drug following oral administration is the same as that following intravenous administration.
   d. The effect of exercise on the absorption of the drug is the same between the 2 products.
10. The most common route for excretion of drugs from the body is:
   a. Renal excretion.
   b. Excretion through sweat.
   c. Biliary excretion.
   d. Excretion through saliva.