

Haveles: Evolve Resources for Applied Pharmacology for the Dental Hygienist, 7th Edition

Chapter 03: Adverse Reactions

Case Studies

Simone J. is a 40-year-old dental hygiene student who suffers from migraine headaches and clinical depression. She is currently taking paroxetine (Paxil) for the depression, oral contraceptives, and propranolol as needed for her migraines. She agrees to be a patient for her classmate, and when her vital signs are taken in the clinic, her blood pressure is 160/100 mm Hg, although it has always been in the normal range in the past. During questioning, she tells her clinician classmate that she recently switched types of oral contraceptives because of weight gain. She also reports that her mouth is dry.

1. When reading the drug information handbook, the clinician discovers that elevated blood pressure can occur when one is taking this brand of oral contraceptive. What is the term for this type of drug reaction?

- a. Drug interaction
- b. Idiosyncratic reaction
- c. Adverse drug reaction
- d. Toxic reaction
- e. Allergic reaction

ANS: C

The elevated blood pressure is a predictable, undesirable, and potentially harmful adverse effect of a drug given in usual therapeutic doses. A drug interaction can occur when the effect of one drug is altered by another drug, and this may result in undesirable effects such as toxicity or lack of efficacy. An idiosyncratic reaction is a genetically related abnormal drug response that makes some populations more susceptible to certain adverse reactions to specific drugs. The toxic effect is also sometimes called an *overdose* because the amount of the desired effect is excessive. An allergic reaction to a drug is an immunologic response to a medication that results in anaphylaxis, a rash, or breathing problems.

2. Simone has not had a migraine headache since she switched oral contraceptives, but while she is in the dental chair, she has an aura and asks the clinician if she can take a propranolol. Shortly after taking the drug, she complains of dizziness and loses consciousness. Which of the following is the most likely cause of this reaction?

- a. Drug interaction
- b. Idiosyncratic reaction
- c. Adverse drug reaction
- d. Toxic reaction
- e. Allergic reaction

ANS: A

The most likely cause of her reaction is a drug interaction between the oral contraceptive and the propranolol. In this case, the three medications interacted in a negative way, causing a dramatic drop in her blood pressure and loss of consciousness. The combination of multiple medications increases the likelihood of negative adverse drug effects. An idiosyncratic reaction is a genetically related abnormal drug response that makes some populations more susceptible to certain adverse reactions to specific drugs. An adverse drug effect is a clinically undesirable effect of the drug. The toxic effect is also sometimes called an *overdose* because the amount of the desired effect is excessive. A hypersensitivity or allergic reaction to a drug is an immunologic response to a medication that results in anaphylaxis, a rash, or breathing problems.

3. Paxil is a U.S. Food and Drug Administration category B drug. If Simone becomes pregnant, can she safely continue taking her antidepressant?

- a. Yes
- b. No

ANS: A

Although no drug is considered totally safe, categories A and B are considered fairly safe as long as risks versus benefits are weighed. The Food and Drug Administration (FDA) has attempted to address safety issues to the unborn child by defining five FDA pregnancy categories: A, B, C, D, and X, ranked from least risky to most risky. Although no drug is considered totally safe, categories A and B are considered fairly safe as long as risks versus benefits are weighed.

4. The prevention of pregnancy by administration of oral contraceptives is termed the

- a. idiosyncratic effect.
- b. hypersensitivity reaction.
- c. local effect.
- d. teratogenic effect.
- e. therapeutic effect.

ANS: E

The clinically desirable actions of a drug are termed the *therapeutic effects*, and the undesirable reactions are termed *adverse drug effects*, or *side effects*. In this case, the prevention of pregnancy by administration of oral contraceptive is the clinically desired effect. An idiosyncratic reaction is a genetically related abnormal drug response that makes some populations more susceptible to certain adverse reactions to specific drugs. A hypersensitivity or allergic reaction to a drug is an immunologic response to a medication that results in anaphylaxis, or a rash or breathing problems. A local effect is an effect of a drug that is confined

to a small area and that does not achieve systemic circulation. A teratogenic effect occurs when a medication taken by a pregnant woman causes harm to the developing fetus.

5. Simone reads in her dental hygiene textbook that dry mouth is a common condition in patients who take Paxil. Which term describes this condition?

- a. Idiosyncratic effect
- b. Hypersensitivity reaction
- c. Adverse effect or side effect
- d. Teratogenic effect
- e. Therapeutic effect

ANS: C

A side effect or adverse drug effect is a dose-related reaction that is not part of the desired therapeutic outcome. It occurs when a drug acts on nontarget organs to produce undesirable effects. The terms *side effect* and *adverse reaction* often are used interchangeably. An idiosyncratic reaction is a genetically related abnormal drug response that makes some populations more susceptible to certain adverse reactions to specific drugs. A hypersensitivity or allergic reaction to a drug is an immunologic response to a medication that results in anaphylaxis, a rash, or breathing problems. A teratogenic effect occurs when a medication taken by a pregnant woman causes harm to the developing fetus. The clinically desirable actions of a drug are termed the *therapeutic effects*.

6. Simone needs quadrant periodontal debridement due to heavy interproximal calculus deposits, and local anesthetic is indicated. After administration of a topical benzocaine anesthetic, her lips swell, and she develops hives all over her body. Which is the most likely type of hypersensitivity reaction she is experiencing?

- a. Type I
- b. Type II
- c. Type III
- d. Type IV
- e. Type V

ANS: A

Based on the symptoms, Simone is probably experiencing a type I hypersensitivity reaction. Hypersensitivity reactions occur when the immune system of an individual responds to the drug administered or applied. Type I reactions are mediated by immunoglobulin E (IgE) antibodies. When a drug antigen binds to IgE antibody, histamine, leukotrienes, and prostaglandins are released, producing vasodilation, edema, and the inflammatory response. The targets of this reaction are the bronchioles, resulting in anaphylactic shock; the respiratory system, resulting in rhinitis and asthma; and the skin, resulting in urticaria and dermatitis. Because these reactions can occur relatively quickly after drug exposure, they are known as immediate hypersensitivity reactions. Type II, or cytotoxic/cytolytic, reactions, are complement-dependent reactions

involving either immunoglobulin G (IgG) or immunoglobulin M (IgM) antibodies. The antigen-antibody complex is fixed to a circulating blood cell, resulting in cell lysis as seen in penicillin-induced hemolytic anemia and methyldopa-induced autoimmune hemolytic anemia. Type III, or Arthus, reactions are mediated by IgG. The drug antigen-antibody complex fixes complement and deposits in the vascular endothelium. The reaction is manifested as serum sickness and includes urticarial skin eruptions, arthralgia, arthritis, lymphadenopathy, and fever. This reaction can be caused by the penicillins and sulfonamides. Type IV, or delayed hypersensitivity, reactions are mediated by sensitized T lymphocytes and macrophages, rather than antibodies. When the cells contact the antigen, an inflammatory reaction is produced by lymphokines, neutrophils, and macrophages. An example of a type IV reaction is allergic contact dermatitis caused by the topical application of drugs.

7. Drug allergies are an immunologic response resulting in a reaction such as a rash or anaphylaxis. Drug allergies are the most common type of adverse drug reactions.

- Both statements are true.
- Both statements are false.
- The first statement is true; the second statement is false.
- The first statement is false; the second statement is true.

ANS: C

The first statement is true; the second statement is false. Drug allergy or hypersensitivity is an immunologic response resulting in a reaction such as a rash or anaphylaxis due to the action of activated antibodies or T lymphocytes or macrophages. However, drug allergies account for less than 5% of all adverse reactions and are neither predictable nor dose related. Patients often self-report an “allergy” when it was another type of adverse reaction or side effect.

8. Paxil has a therapeutic index (TI) of 40. The significance of this therapeutic index is that Paxil is a(n)

- therapeutically useful drug
- nontherapeutically useful drug
- fairly safe medication
- fairly toxic medication
- a and c only
- b and d only

ANS: E

With a TI of 40, Paxil is fairly safe and is a therapeutically useful drug. The ratio LD_{50}/ED_{50} is

the therapeutic index (TI) of a drug: $n = \frac{LD_{50}}{ED_{50}}$. If the value of the TI is small (narrow TI), then

toxicity is more likely. The wider the TI, the safer the drug; if the value of the TI is small (narrow TI), then toxicity is more likely. The lethal dose (LD_{50}), one measure of the toxicity of a drug, is the dose of a drug that kills 50% of the experimental animals. The median effective dose

(ED₅₀) is the dose required to produce a specified intensity of effect in 50% of the animals.