chapter 6

Sulfonamides

Key Terms

agranulocytosis
anorexia
antibacterial
anti-infective
aplastic anemia
bacteriostatic
crystalluria
leukopenia
pruritus
Stevens-Johnson syndrome
stomatitis
thrombocytopenia
urticaria

Chapter Objectives

On completion of this chapter, the student will:

- Discuss the uses, general drug actions, and general adverse reactions, contraindications, precautions, and interactions of the sulfonamides.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking sulfonamides.
- Describe the signs and symptoms associated with Stevens-Johnson syndrome.
- List some nursing diagnoses particular to a patient taking sulfonamides.
- Discuss ways to promote an optimal response to therapy, how to manage adverse reactions, and important points to keep in mind when educating patients about the use of the sulfonamides.

The sulfonamides (sulfa) drugs were the first antibiotic drugs developed that effectively treated infections. Although the use of sulfonamides began to decline after the introduction of more effective anti-infectives, such as the penicillins and other antibiotics, these drugs still remain important for the treatment of certain types of infections.

SULFONAMIDES

Sulfonamides are **antibacterial** agents, meaning they are active against bacteria. Another term that may be used to describe the general action of these drugs is **anti-infective** because they are used to treat infections caused by certain bacteria. Sulfadiazine, sulfisoxazole, and sulfamethizole are examples of sulfonamide preparations.

ACTIONS

The sulfonamides are primarily **bacteriostatic,** which means they slow or retard the multiplication of bacteria. This bacteriostatic activity is due to sulfonamide antagonism to para-aminobenzoic acid (PABA), a substance that some, but not all, bacteria need to multiply. Once the rate of bacterial multiplication is slowed, the body's own defense mechanisms (white blood cells) are able to rid the body of the invading microorganisms and therefore control the infection.

USES

The sulfonamides are often used to control urinary tract infections caused by certain bacteria such as *Escherichia coli, Staphylococcus aureus,* and *Klebsiella-Enterobacter*. Mafenide (Sulfamylon) and silver sulfadiazine (Silvadene) are topical sulfonamides used in the treatment of second- and third-degree burns. Additional uses of the sulfonamides are given in the Summary Drug Table: The Sulfonamides.

ADVERSE REACTIONS

The sulfonamides are capable of causing a variety of adverse reactions. Some of these are serious or potentially

SUMMARY DRUG TABLE THE SULFONAMIDES

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
Single Agents				
sulfadiazine *sul-fa-dye'-a-zeen*	*generic*	Urinary tract infections due to susceptible microorganisms, chancroid, acute otitis media, *Hemophilus influenzae* and meningococcal meningitis, rheumatic fever	Hematologic changes, Stevens-Johnson syndrome, nausea, vomiting, headache, diarrhea, chills, fever, anorexia, crystalluria, stomatitis, urticaria, pruritus	Loading dose: 2–4 g PO; maintenance dose: 2–4 g/d PO in 4–6 divided doses
sulfamethizole *sul-fa-meth´-i-zole*	Thiosulfil Forte	Urinary tract infections due to susceptible microorganisms	Same as sulfadiazine	0.5–1 g PO tid, qid
sulfamethoxazole *sul-fa-meth-ox´-a-zole*	Gantanol, Urobak, *generic*	Urinary tract infections due to susceptible microorganisms, meningococcal meningitis, acute otitis media	Same as sulfadiazine	Initial dose: 2 g PO, maintenance dose: 1 g PO bid, tid
sulfasalazine *sul-fa-sal'-a-zeen*	Azulfidine, Azulfidine EN-tabs, *generic*	Ulcerative colitis, rheumatoid arthritis	Same as sulfadiazine; may cause skin and urine to turn orange-yellow	Initial therapy: 1–4 g/d PO in divided doses; maintenance dose: 2 g/d in evenly spaced doses 500 mg qid
sulfisoxazole *sul-fi-sox´-a-zole*	*generic*	Same as sulfadiazine	Same as sulfadiazine	Loading dose: 2–4 g PO; maintenance dose: 4–8 g/d PO in 4–6 divided doses
Multiple Preparations				
trimethoprim (TMP) and sulfamethoxazole (SMZ) *trye-meth´-oh-prim*; *sul-fa-meth-ox´-a-zole*	Bactrim, Bactrim DS, Septra, Septra DS, *generic*	Urinary tract infections due to susceptible microorganisms, acute otitis media, traveler's diarrhea due to *Escherichia coli*	Gastrointestinal disturbances, allergic skin reactions, hematologic changes, Stevens-Johnson syndrome, headache	160 mg TMP/800 mg SMZ PO q12h; 8–10 mg/kg/d (based on TMP) IV in 2–4 divided doses
Miscellaneous Sulfonamide Preparations				
mafenide *meph´-a-nide*	Sulfamylon	Second- and third-degree burns	Pain or burning sensation, rash, itching, facial edema	Apply to burned area 1–2 times/d
silver sulfadiazine *sil´-ver sul-fa-dye'-a-zeen*	Silvadene, Thermazene, SSD (cream)	Same as mafenide	Leukopenia, skin necrosis, skin discoloration, burning sensation	Same as mafenide

*The term *generic* indicates the drug is available in generic form.

serious; others are mild. The following hematologic changes may occur during sulfonamide therapy:

- **Agranulocytosis**—decrease in or lack of granulocytes, a type of white blood cell
- **Thrombocytopenia**—decrease in the number of platelets
- **Aplastic anemia**—anemia due to deficient red blood cell production in the bone marrow
- **Leukopenia**—decrease in the number of white blood cells

These are examples of a serious adverse reaction. If any of these occur, discontinuation of sulfonamide therapy may be required.

Anorexia (loss of appetite) is an example of a mild adverse reaction. Unless it becomes severe and pronounced weight loss occurs, it may not be necessary to discontinue sulfonamide therapy.

Various types of hypersensitivity (allergic) reactions may be seen during sulfonamide therapy, including Stevens-Johnson syndrome, **urticaria** (hives), **pruritus** (itching), and generalized skin eruptions. **Stevens-Johnson syndrome** is manifested by fever, cough, muscular aches and pains, and headache, all of which are signs and symptoms of many other disorders. However, the appearance of lesions on the skin, mucous membranes, eyes, and other organs are diagnostically significant and may be the first conclusive signs of this syndrome. Any of these symptoms must be reported to the primary health care provider immediately.

Other adverse reactions that may occur during therapy include nausea, vomiting, diarrhea, abdominal pain, chills, fever, and **stomatitis** (inflammation of the mouth). In some instances, these may be mild. Other times they may cause serious problems requiring discontinuation of the drug. Sulfasalazine may cause the urine and skin to be an orange-yellow color; this is not abnormal.

Crystalluria (crystals in the urine) may occur during administration of a sulfonamide, although this problem occurs less frequently with some of the newer sulfonamide preparations. This potentially serious problem often can be prevented by increasing fluid intake during sulfonamide therapy.

The most frequent adverse reaction seen with the application of mafenide is a burning sensation or pain when the drug is applied to the skin. Other possible allergic reactions include rash, itching, edema, and urticaria. Burning, rash, and itching may also be seen with the use of silver sulfadiazine. It may be difficult to distinguish between an adverse reaction due to the use of mafenide or silver sulfadiazine and reactions that may occur from the severe burn injury or from other agents used at the same time for the management of the burns.

CONTRAINDICATIONS

The sulfonamides are contraindicated in patients with hypersensitivity to the sulfonamides, during lactation, and in children less than 2 years old. The sulfonamides are not used near the end (at term) of pregnancy (Pregnancy Category D). If the sulfonamides are given near the end of pregnancy, significant blood levels of the drug may occur, causing jaundice or hemolytic anemia in the neonate. Additionally, the sulfonamides are not used for infections caused by group A beta-hemolytic streptococci because the sulfonamides have *not* been shown to be effective in preventing the complications of rheumatic fever or glomerulonephritis.

PRECAUTIONS

The sulfonamides are used with caution in patients with renal or hepatic impairment and bronchial asthma. These drugs are given with caution to patients with allergies. Safety for use during pregnancy has not been established (Pregnancy Category C, except at term).

INTERACTIONS

When a sulfonamide is administered with an oral anticoagulant, the action of the anticoagulant may be enhanced. The risk of bone marrow suppression may be increased when a sulfonamide is administered with methotrexate. When a sulfonamide is administered with a hydantoin, the serum hydantoin level may be increased.

Sulfonamides may inhibit the (hepatic) metabolism of the oral hypoglycemic drugs tolbutamide (Orinase) and chlorpropamide (Diabinese). This would increase the possibility of a hypoglycemic reaction.

Health Supplement Alert: Cranberry

Cranberries and cranberry juice are a commonly used remedy for the prevention of urinary tract infections (UTIs) and for the relief of symptoms from UTIs. The use of cranberry juice in combination with antibiotics has been recommended by physicians for the long-term suppression of UTIs. Cranberries are thought to act by preventing the bacteria from attaching to the walls of the urinary tract. The suggested amount is 6 ounces of the juice two times daily. Extremely large doses can produce gastrointestinal disturbances such as diarrhea or abdominal cramping. Although cranberries may relieve the symptoms of a UTI or prevent the occurrence of a UTI, their use will not cure a UTI. If an individual suspects a UTI, medical attention is necessary.

NURSING PROCESS

The Patient Receiving a Sulfonamide

ASSESSMENT

Preadministration Assessment

Before the initial administration of the drug, it is important to assess the patient's general appearance and take and record the vital signs. The nurse obtains information regarding the symptoms experienced by the patient and the length of time these symptoms have been present. Depending on the type and location of the infection or disease, the nurse reviews the results of tests, such as a urine culture, urinalysis, complete blood count, intravenous pyelogram, renal function tests, and examination of the stool.

Ongoing Assessment

During the course of therapy, the nurse evaluates the patient at periodic intervals for response to the drug, that is, a relief of symptoms and a decrease in temperature (if it was elevated before therapy started), as well as the occurrence of any adverse reactions.

The nurse monitors the temperature, pulse, respiratory rate, and blood pressure every 4 hours or as ordered by the primary health care provider. If fever is present and the patient's temperature suddenly increases or if the temperature was normal and suddenly increases, the nurse contacts the primary health care provider immediately.

The ongoing assessment for patients receiving sulfasalazine for ulcerative colitis includes observation for evidence of the relief or intensification of the symptoms of the disease. The nurse inspects all stool samples and records their number and appearance.

When administering a sulfonamide for a burn, the nurse inspects the burned areas every 1 to 2 hours because some treatment regimens require keeping the affected areas covered with the mafenide or silver sulfadiazine ointment at all times. Any adverse reactions should be reported immediately to the primary health care provider.

NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to the drugs are discussed in depth in Chapter 4.

Nursing Diagnoses Checklist

- ✓ **Risk for Infection** related to adverse reactions of the sulfonamides
- ✓ **Risk for Impaired Skin Integrity** related to adverse drug reaction of the sulfonamides
- ✓ **Impaired Urinary Elimination** related to adverse drug reaction of the sulfonamides

PLANNING

The expected outcomes of the patient depend on the reason for administration of the sulfonamide but may include an optimal response to drug therapy, management of adverse drug reactions, and an understanding of and compliance with the prescribed treatment regimen.

IMPLEMENTATION

Promoting an Optimal Response to Therapy

The patient receiving a sulfonamide drug almost always has an active infection. Some patients may be receiving one of these drugs to prevent an infection (prophylaxis) or as part of the management of a disease such as ulcerative colitis.

Unless the primary health care provider orders otherwise, the nurse gives sulfonamides to the patient whose stomach is empty, that is, 1 hour before or 2 hours after meals. If gastrointestinal irritation occurs, the nurse may give sulfasalazine with food or immediately after meals. It is important to instruct the patient to drink a full glass of water when taking an oral sulfonamide and to drink at least eight large glasses of water each day until therapy is finished.

Managing Burns

When mafenide or silver sulfadiazine is used in the treatment of burns, the treatment regimen is outlined by the primary health care provider or the personnel in the burn treatment unit. There are various burn treatment regimens, such as debridement (removal of burned or dead tissue from the burned site), special dressings, and cleansing of the burned area. The use of a specific treatment regimen often depends on the extent of the burned area, the degree of the burns, and the physical condition and age of the patient. Other concurrent problems, such as lung damage due to smoke or heat or physical injuries that occurred at the time of the burn injury, also may influence the treatment regimen.

When instructed to do so, the nurse cleans and removes debris present on the surface of the skin before each application of mafenide or silver sulfadiazine and applies these drugs with a sterile gloved hand. The drug is applied approximately 1/16 inch thick; thicker application is not recommended. The patient is kept away from any draft of air because even the slightest movement of air across the burned area can cause pain. It is important to warn the patient that stinging or burning may be felt during, and for a short time after, application of mafenide. Some burning also may be noted with the application of silver sulfadiazine.

Monitoring and Managing Adverse Drug Reactions

The nurse must observe the patient for adverse reactions, especially an allergic reaction (see Chap. 1). If one or more adverse reactions should occur, the nurse withholds the next dose of the drug and notifies the primary health care provider.

The nurse monitors the patient for leukopenia and thrombocytopenia. Leukopenia may result in signs and symptoms of an infection, such as fever, sore throat, and cough. The nurse protects the patient with leukopenia from individuals who have an infection. With severe leukopenia the patient may be placed in protective (reverse) isolation. Thrombocytopenia is manifested by easy bruising and unusual bleeding following moderate to slight trauma to the skin or mucous membranes. The extremities of the patient with thrombocytopenia are handled with care to prevent bruising. Care is taken to prevent trauma when the patient is moved. The nurse inspects the skin daily for the extent of bruising and evidence of exacerbation of existing ecchymotic areas. It is important to encourage the patient to use a soft-bristled toothbrush to prevent any trauma to the mucous membranes of the oral cavity. The nurse reports any signs of leukopenia or thrombocytopenia immediately because this is an indication to stop drug therapy.

Nursing Alert

Stevens-Johnson syndrome is a serious and sometimes fatal hypersensitivity reaction. The nurse must be alert for lesions on the skin and mucous membranes, a diagnostically important symptom of this syndrome. The lesions appear as red wheals or blisters, often starting on the face, in the mouth, or on the lips, neck, and extremities. This syndrome, which also may occur with the administration of other types of drugs, can be fatal. The nurse must notify the primary health care provider and withhold the next dose of the drug. In addition, the nurse must exercise care to prevent injury to the involved areas.

Maintaining Adequate Fluid Intake and Output

Because one adverse reaction of the sulfonamide drugs is altered elimination patterns, it is important that the nurse helps the patient maintain adequate fluid intake and output. The nurse can encourage patients to increase fluid intake to 2000 mL or more a day to prevent crystalluria and stone formation in the genitourinary tract, as well as to aid in the removal of microorganisms from the urinary tract. It is important to measure and record the intake and output every 8 hours and notify the primary health care provider if the urinary output decreases or the patient fails to increase his or her oral intake.

Gerontologic Alert

Because renal impairment is common in older adults, the nurse should give the sulfonamides with great caution. There is an increased danger of the sulfonamides causing additional renal damage when renal impairment is already present. An increase of fluid intake up to 2000 mL (if the older adult can tolerate this amount) decreases the risk of crystals and stones forming in the urinary tract.

Educating the Patient and Family

When a sulfonamide is prescribed for an infection, some outpatients have a tendency to discontinue the drug once symptoms have been relieved. When teaching the patient and the family, the nurse emphasizes the importance of completing the prescribed course of therapy to be sure all microorganisms causing the infection are eradicated. Failure to complete a course of therapy may result in a recurrence of the infection. The nurse should develop a teaching plan to include the following information:

- Take the drug as prescribed.
- Take the drug on an empty stomach either 1 hour before or 2 hours after a meal (exception: sulfasalazine is taken with food or immediately after a meal).
- Take the drug with a full glass of water. Do not increase or decrease the time between doses unless directed to do so by the primary health care provider.
- Complete the full course of therapy. Do not discontinue this drug (unless advised to do so by the primary health care provider) even though the symptoms of the infection have disappeared.
- Drink *at least* 8 to 10 8-oz glasses of fluid every day.
- Prolonged exposure to sunlight may result in skin reactions similar to a severe sunburn (photosensitivity reactions). When going outside, cover exposed areas of the skin or apply a protective sunscreen to exposed areas.
- Notify the primary health care provider immediately if the following should occur: fever, skin rash or other skin problems, nausea, vomiting, unusual bleeding or bruising, sore throat, or extreme fatigue.
- Keep all follow-up appointments to ensure the infection is controlled.
- When taking sulfasalazine, the skin or urine may turn an orange-yellow color; this is not abnormal. If the patient wears soft contact lenses, a permanent yellow stain of the lenses may occur. It is a good idea to seek the advice of an ophthalmologist regarding corrective lenses while taking this drug.

EVALUATION

- The therapeutic drug effect is achieved.
- No evidence of infection is seen.
- The skin is intact and free of inflammation, irritation, or ulcerations.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully through appropriate nursing interventions.
- The patient verbalizes the importance of complying with the prescribed treatment regimen.
- The patient and family demonstrate an understanding of the drug regimen.

● Critical Thinking Exercises

1. *Ms. Bartlett, age 80, has been prescribed a sulfonamide for a urinary tract infection and is to take the drug for 10 days. You note that Ms. Bartlett seems forgetful and at times confused. Determine what problems might be associated with Ms. Bartlett's mental state and her possible noncompliance to her prescribed treatment regimen.*
2. *Mr. Garcia is receiving sulfisoxazole for a recurrent bladder infection. When keeping an outpatient clinic appointment, he tells you that he developed a fever and sore throat yesterday. Analyze the steps you would take to investigate his recent problem. Give a reason for your answers.*
3. *Ms. Watson has diabetes and is taking tolbutamide (Orinase). Her primary care provider prescribes the combination drug sulfamethoxazole and trimethoprim (Septra) for a bladder infection. Discuss any instructions/information you would give to Ms. Watson in the patient education session.*

● Review Questions

1. A nurse working in the clinic asks how the sulfonamides control an infection. The most correct answer is that these drugs _____.
   - **A.** encourage the production of antibodies
   - **B.** antagonize PABA, which some bacteria need to multiply
   - **C.** reduce the urine output
   - **D.** make the urine alkaline, which eliminates bacteria
2. Patients receiving sulfasalazine for ulcerative colitis are told that the drug _____.
   - **A.** is not to be taken with food
   - **B.** rarely causes adverse effects
   - **C.** may cause hair loss
   - **D.** may turn the urine orange-yellow in color
3. When mafenide (Sulfamylon) is applied to a burned area, the nurse _____.
   - **A.** first covers the burned area with a sterile compress
   - **B.** irrigates the area with normal saline
   - **C.** warns the patient that stinging or burning may be felt
   - **D.** instructs the patient to drink two to three extra glasses of water each day
4. The nurse can evaluate the patient's response to therapy by asking him if _____.
   - **A.** he completed the entire course of therapy
   - **B.** his symptoms have been relieved
   - **C.** he has seen any evidence of blood in the urine
   - **D.** has experienced any constipation

● Medication Dosage Problems

1. The primary health care provider prescribed sulfasalazine oral suspension 500 mg every 8 hours. The nurse has sulfasalazine oral suspension 250 mg/5 mL on hand. What dosage would the nurse give?
2. The nurse orders sulfamethoxazole 2 g PO initially, followed by 1 g PO BID. The nurse has 1000-mg tablets on hand. How many tablets would the nurse give for the initial dose?