Bronchodilators and Antiasthma Drugs

Key Terms

asthma bronchodilator leukotriene sympathomimetic theophyllinization xanthine derivatives

Chapter Objectives

On completion of this chapter, the student will:

- Describe the uses, general drug action, general adverse reactions, contraindications, precautions, and interactions of the bronchodilators and antiasthma drugs.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking the bronchodilators or antiasthma drugs
- List some nursing diagnoses particular to a patient taking a bronchodilator or an antiasthma drug.
- Discuss ways to promote an optimal response to therapy, how to manage common adverse reactions, and important points to keep in mind when educating a patient about the use of a bronchodilator or an antiasthma drug.

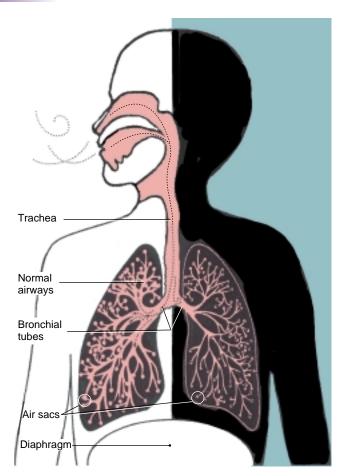
Within the past few years a number of new drugs have been introduced to treat respiratory disorders, such as bronchial asthma and disorders that produce chronic airway obstruction. This chapter discusses the bronchodilators, drugs that have been around for a long time but are still effective in specific instances, and the newer antiasthma drugs that have proven to be highly effective in the prophylaxis (prevention) of breathing difficulty.

Asthma is a reversible obstructive disease of the lower airway. With asthma there is increasing airway obstruction caused by bronchospasm and bronchoconstriction, inflammation and edema of the lining of the bronchioles, and the production of thick mucus that can plug the airway (see Fig. 37-1). There are three types of asthma:

- Extrinsic (also referred to as allergic asthma and caused in response to an allergen such as pollen, dust, and animal dander)
- Intrinsic asthma (also called nonallergic asthma and caused by chronic or recurrent respiratory infections, emotional upset, and exercise)
- 3. Mixed asthma (caused by both intrinsic and extrinsic factors)

Extrinsic or allergic asthma causes the IgE inflammatory response. With exposure, the IgE antibodies are produced and attach to mast cells in the lung. Reexposure to the antigen causes them to bind to the IgE antibody, releasing histamine and other mast cell products. The release of these products causes bronchospasm, mucous membrane swelling, and excessive mucous production. Gas exchange is impaired, causing carbon dioxide to be trapped in the alveoli so that oxygen is unable to enter. Figure 37-2 identifies the asthmatic pathway from both intrinsic and extrinsic stimulus.

Other disorders of the lower respiratory tract include emphysema (lung disorder in which the terminal bronchioles or alveoli become enlarged and plugged with mucus) and chronic bronchitis (chronic inflammation and possibly infection of the bronchi). Chronic obstructive pulmonary disease (COPD) is the name given collectively to emphysema and chronic bronchitis because the obstruction to the airflow is present most of the time. Asthma that is persistent and present for most of the time may also be referred to as COPD.



UNIT V

FIGURE 37-1. Left column. *Normal lungs:* Air comes into the body through the nose and mouth. Air then goes through the trachea pipe into all the airways. The air reaches the tiny air sacs deep in the lungs, where gas exchanges takes place. **Right column.** *Lungs in asthma:* In asthma, the patient has trouble moving air through the lungs because airways become narrow as the muscles in their walls tighten and the airway walls swell up. The swollen walls give off extra mucus, which clogs the narrowed airways.

BRONCHODILATORS

A **bronchodilator** is a drug used to relieve bronchospasm associated with respiratory disorders, such as bronchial asthma, chronic bronchitis, and emphysema. These conditions are progressive disorders characterized by a decrease in the inspiratory and expiratory capacity of the lung. Collectively, they are often referred to as COPD. The patient with COPD experiences dyspnea (difficulty breathing) with physical exertion, has difficulty inhaling and exhaling, and may exhibit a chronic cough.

The two major types of bronchodilators are the sympathomimetics and the xanthine derivatives. The anticholinergic drug ipratropium bromide (Atrovent) is used for bronchospasm associated with COPD, chronic bronchitis, and emphysema. Ipratropium is included in the Summary Drug Table: Bronchodilators. Chapter 25

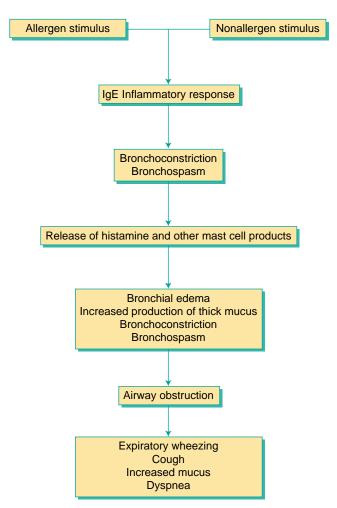


FIGURE 37-2. Asthmatic pathway from intrinsic and extrinsic stimulus. (Source: Timby, B., Scherer, J. & Smith, N. [1999]. *Introductory medical-surgical nursing* [7th ed., p. 46]. Philadelphia: Lippincott Williams & Wilkins.

provides specific information concerning the anticholinergic drugs (cholinergic blocking drugs).

Bronchodilators: Sympathomimetic

Examples of sympathomimetic bronchodilators include albuterol (Ventolin), epinephrine (Adrenalin), salmeterol (Serevent), and terbutaline (Brethine). Many of the sympathomimetics used as bronchodilators have the subclassification of beta-2 (β_2) receptor agonists (eg, albuterol, salmeterol, and terbutaline). Additional information concerning the various sympathomimetic drugs is given in the Summary Drug Table: Bronchodilators.

ACTIONS

When bronchospasm occurs, there is a decrease in the lumen (or inside diameter) of the bronchi, which decreases the amount of air taken into the lungs with



SUMMARY DRUG TABLE BRONCHODILATORS

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
Sympathomimetics				
albuterol sulfate al-byoo'-ter-ole	Proventil, Ventolin, Volmax, generic	Bronchospasm, prevention of exercise- induced bronchospasm (EIB)	Palpitations, tachycardia, hypertension, tremor, dizziness, shakiness, nervousness, nausea, vomiting	2–4 mg TID, QID PO; 1–2 inhalations q4–6h; 2 inhalations before exercise; may also be given by nebulization Volmax: 4–8 mg q12h PO, up to 32 mg/d
bitolterol mesylate bye-tole'-ter-ole	Tornalate	Asthma, bronchospasm	Palpitations, hypertension, dizziness, vertigo, tremor, nervousness, headache, throat irritation	2 inhalations q8h; inhalation solution; 2.5 mg over 10–15 mins with continuous flow system or 1 mg with intermittent flow system
ephedrine sulfate e-fed'-rin	generic	Asthma, bronchospasm	Palpitations, tachycardia, hypertension, arrhythmias, dizziness, vertigo, shakiness, nervousness, headache, insomnia, nausea, vomiting	25–50 mg PO q3–4h PRN; 25–50 mg IM, SC, IV
epinephrine ep-i-nef'-rin	Adrenalin, Epinephrine Mist, Primatene Mist, <i>generic</i>	Asthma, bronchospasm	Palpitations, tachycardia, hypertension, arrhythmias, dizziness, vertigo, shakiness, nervousness, headache, insomnia, nausea, vomiting, anxiety, fear, pallor	Inhalation aerosol: individualize dose; injection: solution 1:1000, 0.3–0.5 mL SC, IM Suspension (1:200): 0.1–0.3 mL SC only
formoterol fumarate for-moh'-te-rol	Foradil Aerolizer	Maintenance treatment of asthma, prevention of EIB	Palpitations, tachycardia, dizziness, nervousness	1 12-µg capsule q12h using Aerolizer Inhaler; EIB 1 12-mcg capsule 15 min before exercise using the Aerolizer Inhaler
isoetharine eye-soe-eth'-a- reen	generic	Asthma, bronchospasm	Palpitations, tachycardia, hypertension, tremor, dizziness, nervousness, weakness, restlessness, hyperactivity, headache, insomnia, nausea, vomiting	Hand-held nebulizer: 3–7 inhalations 1:3 dilution or 4 inhalations undiluted
isoproterenol HCl eye-soe-proe- ter'-a-nole	Isuprel, generic	Bronchospasm during anesthesia, vasopressor during shock	Palpitations, tachycardia, chest tightness, angina, shakiness, nervousness, weakness, hyperactivity, headache, nausea, vomiting, flushing, sweating	0.01–0.02 mg IV, repeat if necessary; dilute 1 mL of a 1:5000 solution to 10 mL with sodium chloride injec- tions of 5% dextrose IV
levalbuterol HCl lev-al-byoo'-ter-ole	Xopenex	Bronchospasm	Tachycardia, nervousness, anxiety, pain, dizziness, rhinitis, cough, cardiac arrhythmias	0.63 mg TID, every 6–8h by nebulization; if no response, dose may be increased to 1.25 mg TID by nebulization
metaproterenol sulfate met-a-proe- ter'-e-nole	Alupent, generic	Asthma, bronchospasm	Tachycardia, tremor, nervousness, shakiness, nausea, vomiting	Aerosol 2–3 inhalations q3–4h; do not exceed 12 inhalations
pirbuterol acetate peer-byoo'-ter-ole	Maxair Autohaler, Maxair Inhaler	Asthma, bronchospasm	Shakiness, nervousnes, nausea, tachycardia	2 inhalations q4–6h; do not exceed 12 inhalations
salmeterol sal-mee'-ter-ol	Serevent	Asthma, bronchospasm	Palpitations, tachycardia, tremor, nervousness, headache, nausea, vomiting, heartburn, GI distress, diarrhea, cough, rhinitis	Asthma/bronchospasm: aerosol, 2 inhalations BID morning and evening; inhalation powder, 1 (50 mcg) inhalation BID (continued)



SUMMARY DRUG TABLE BRONCHODILATORS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
terbutaline sulfate ter-byoo'-ta-leen	Brethine, generic	Asthma, bronchospasm	Palpitations, tremor, dizziness, vertigo, shakiness, nervousness, drowsiness, headache, nausea, vomiting, GI upset	2.5–5 mg q6h PO TID during waking hours; 0.25 mg SC (may repeat one time if needed)
Xanthine Derivative	es			
aminophylline am-in-off'-i-lin	Phyllocontin, Truphylline, <i>generic</i>	Symptomatic relief or prevention of bronchial asthma and reversible bronchospasm of chronic bronchitis and emphysema	Nausea, vomiting, diarrhea, headache, insomnia, irritability, hyperglycemia, hypotension, cardiac arrhythmias, tachycardia, tachypnea, seizures	Individualize dosage: base adjustments on clinical responses, monitor serum theophylline levels, maintain therapeutic range of 10–20 mcg/mL; base dosage on lean body mass
dyphylline dye'-fi-lin	Lufyllin	Same as aminophylline	Same as aminophylline	Up to 15 mg/kg PO QID; 250–500 mg IM
oxtriphylline ox-trye'-fi-lin	Choledyl, generic	Same as aminophylline	Same as aminophylline	4.7 mg/kg q8h PO; sustained action: 1 tablet q12h PO
theophylline thee-off'-i-lin	Theo-24, Theo-dur, Theolair, Slo-bid, Uniphyl, <i>generic</i>	Same as aminophylline	Same as aminophylline	Long-term therapy: 16 mg/kg/24h or 400 mg/24h in divided doses. Monitor serum theophylline levels.
Anticholinergic				
ipratropium bromide ih-prah-trow'-pea- um	Atrovent, generic	Bronchospasm associated with chronic obstructive pulmonary disease, chronic bronchitis and emphysema, rhinorrhea	Dryness of the oropharynx, nervousness, irritation from aerosol, dizziness, headache, GI distress, dry mouth, exacerbation of symptoms, nausea, palpitations	Aerosol: 2 inhalations (36 μ g) QID, not to exceed 12 inhalations; solution: 500 μ g (1 unit dose vial) TID, QID by oral nebulization; nasal spray: 2 sprays per nostril BID, TID of 0.03% or 2 sprays per nostril TID, QID of 0.06%

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

each breath. A decrease in the amount of air taken into the lungs results in respiratory distress. Use of a bronchodilating drug opens the bronchi and allows more air to enter the lungs, which in turn, completely or partially relieves respiratory distress.

USES

Sympathomimetics (drugs that mimic the sympathetic nervous system) are used primarily to treat reversible airway obstruction caused by bronchospasm associated with acute and chronic bronchial asthma, exercise-induced bronchospasm, bronchitis, emphysema, bronchiectasis (abnormal condition of the bronchial tree), or other obstructive pulmonary diseases.

ADVERSE REACTIONS

Administration of a sympathomimetic bronchodilator may result in restlessness, anxiety, increase in blood pressure, palpitations, cardiac arrhythmias, and insomnia. When these drugs are used by inhalation, excessive use (eg, over the recommended times) may result in paradoxical bronchospasm.

CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

The sympathomimetic bronchodilators are contraindicated in patients with known hypersensitivity to the drug, cardiac arrhythmias associated with tachycardia,

organic brain damage, cerebral arteriosclerosis, and narrow angle glaucoma. Salmeterol is contraindicated during acute bronchospasm. The sympathomimetics are used cautiously in patients with hypertension, cardiac dysfunction, hyperthyroidism, glaucoma, diabetes, prostatic hypertrophy, or a history of seizures. The sympathomimetic drugs are used cautiously during pregnancy (all are Pregnancy Category C, except terbutaline, which is Pregnancy Category B), and lactation.

When the sympathomimetics are used concurrently with other sympathomimetic drugs (see Chap. 22), additive adrenergic effects can occur. When used with the monoamine oxidase inhibitors (see Chap. 29), the patient is at increased risk for a hypertensive crisis. When the sympathomimetics are administered with a β-adrenergic blocker, the drugs may inhibit the cardiac, bronchodilating, and vasodilating effects of the sympathomimetic. When a β-blocker such as propranolol is administered with a sympathomimetic such as epinephrine, an initial hypertensive episode may occur followed by bradycardia. Concurrent use of the sympathomimetics with oxytocic drugs may result in severe hypotension. When the sympathomimetics are administered with theophylline there is an increased risk for cardiotoxicity. When epinephrine is administered with insulin or oral hypoglycemic drugs, the patient may require an increased dose of the hypoglycemic drug.

Bronchodilators: Xanthine Derivatives

Examples of the xanthine derivatives (drugs that stimulate the central nervous system [CNS] resulting in bronchodilation, also called methylxanthines) are theophylline and aminophylline. Additional information concerning the xanthine derivatives is found in the Summary Drug Table: Bronchodilators.

ACTIONS

The xanthine derivatives, although a different class of drugs, also have bronchodilating activity by means of their direct relaxation of the smooth muscles of the bronchi.

USES

The xanthine derivatives are used for symptomatic relief or prevention of bronchial asthma and reversible bronchospasm associated with chronic bronchitis and emphysema.

ADVERSE REACTIONS

Adverse reactions associated with administration of the xanthine derivatives include nausea, vomiting, restlessness, nervousness, tachycardia, tremors, headache, palpitations, increased respirations, fever, hyperglycemia, and electrocardiographic changes.

CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

The xanthine derivatives are contraindicated in those with known hypersensitivity, peptic ulcers, seizure disorders (unless well controlled with appropriate anticonvulsant medication), serious uncontrolled arrhythmias, and hyperthyroidism.

The xanthine derivatives are used cautiously in patients older than 60 years, those with cardiac disease, hypoxemia, hypertension, congestive heart failure, or liver disease. Aminophylline, dyphylline, oxtriphylline, and theophylline are Pregnancy Category C drugs and are used cautiously during pregnancy and lactation.

When xanthine bronchodilators are administered with sympathomimetic drugs (see Chap. 22), additive CNS and cardiovascular effects may occur. If a patient eats large amounts of charcoal-broiled foods while taking the xanthines, a decrease in the therapeutic effect of the xanthines may occur. Certain foods contain xanthine (eg, coffee, colas, or chocolate) and may increase the risk of cardiac and CNS adverse reactions. Cigarettes, nicotine gum and patches, barbiturates, phenytoin, loop diuretics, isoniazid, and rifampin may decrease the effectiveness of the xanthines. There is an increased risk of xanthine toxicity when the drugs are administered with influenza vaccination, oral contraceptives, glucocorticoids, β-adrenergic blockers, cimetidine, macrolides, thyroid hormones, or allopurinol.

ANTIASTHMA DRUGS

Asthma is a respiratory condition characterized by recurrent attacks of dyspnea (difficulty breathing) and wheezing caused by spasmodic constriction of the bronchi. With asthma, the body responds with a massive inflammation. During the inflammatory process, large amounts of histamine are released from the mast cells of the respiratory tract, causing symptoms such as increased mucous production and edema of the airway and resulting in bronchospasm and inflammation. With asthma the airways become narrow, the muscles around the airway tighten, the inner lining of the bronchi swell, and extra mucus clogs the smaller airways. (See Fig. 37-1.)

Along with the bronchodilators, several types of drugs are effective in the treatment of asthma. These include corticosteroids, leukotriene formation inhibitors, leukotriene receptor agonists, and mast cell stabilizers.

Antiasthma drugs are used in various combinations to treat and manage asthma. Using several drugs may be more beneficial than using a single drug. A multidrug regimen allows smaller dosages of each drug, decreasing the number and severity of adverse reactions. Various combinations of these drugs are used depending on the patient's response.

Antiasthma Drugs: Corticosteroids

ACTIONS

Corticosteroids, such as beclomethasone (Beclovent), flunisolide (AeroBid), and triamcinolone (Azmacort), are given by inhalation and act to decrease the inflammatory process in the airways of the patient with asthma. In addition, the corticosteroids increase the sensitivity of the β_2 -receptors. With increased sensitivity of the β_2 -receptors, the β_2 -receptor agonist drugs are more effective.

USES

The corticosteroids are used in the management and prophylactic treatment of the inflammation associated with chronic asthma or allergic rhinitis.

ADVERSE REACTIONS

When used to manage chronic asthma, the corticosteroids are most often given by inhalation. Adverse reactions to the corticosteroids are less likely to occur when the drugs are given by inhalation rather than taken orally. Occasionally, patients may experience throat irritation causing hoarseness, cough, or fungal infection of the mouth and throat. Vertigo or headache also may occur. See Chapter 50 for adverse reactions after oral administration of the corticosteroids. A more complete listing of the adverse reactions associated with the corticosteroids is found in the Summary Drug Table: Antiasthma Drugs.

CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

The corticosteroids are contraindicated in patients with hypersensitivity to the corticosteroids, acute bronchospasm, status asthmaticus, or other acute episodes of asthma. Vanceril is contraindicated for the relief of symptoms that can be controlled by a bronchodilator and other nonsteroidal medications and in the treatment of nonasthmatic bronchitis. The corticosteroids are used cautiously in patients with compromised immune systems, glaucoma, kidney or liver disease, convulsive disorders, or diabetes, those taking systemic corticosteroids, and during pregnancy (Pregnancy Category C) and lactation. Ketoconazole may increase plasma levels of budesonide and fluticasone.

Antiasthma Drugs: Leukotriene Receptor Antagonists and Leukotriene Formation Inhibitors

Leukotriene receptor antagonists include montelukast sodium (Singulair) and zafirlukast (Accolate). Zileuton (Zyflo) is classified as a leukotriene formation inhibitor. Additional information concerning these drugs is found in the Summary Drug Table: Antiasthma Drugs.

ACTIONS

Leukotrienes are bronchoconstrictive substances released by the body during the inflammatory process. When leukotriene production is inhibited, bronchodilation is facilitated. Zileuton acts by decreasing the formation of leukotrienes. Although the result is the same, montelukast and zafirlukast work in a manner slightly differently from that of zileuton. Montelukast and zafirlukast are considered leukotriene receptor antagonists because they inhibit leukotriene receptor sites in the respiratory tract, preventing airway edema and facilitating bronchodilation.

USES

Zafirlukast and zileuton are used in the prophylaxis and treatment of chronic asthma in adults and children older than 12 years. Montelukast is used in the prophylaxis and treatment of chronic asthma in adults and in children older than 2 years.

ADVERSE REACTIONS

Adverse reactions of zafirlukast (Accolate) include headache, dizziness, myalgia, pain, nausea, diarrhea, abdominal pain, vomiting, and fever. Montelukast (Singulair) administration may cause headache, dizziness, dyspepsia, flu-like symptoms, cough, abdominal pain, and fatigue. Adverse reactions seen with the



SUMMARY DRUG TABLE ANTIASTHMA DRUGS

GENERIC NAME	TRADE NAME	USES	ADVERSE REACTIONS	DOSAGE RANGES
Corticosteroids				
beclomethasone dipropionate be-kloe-meth'- a-sone	Beconase AQ, QVAR, Vanceril, Vanceril Double Strength	Respiratory inhalant use: asthma Intranasal use: seasonal or perennial rhinitis, prevention of recurrence of nasal polyps after surgical removal	Oral, laryngeal, pharyngeal irritation, fungal infections, suppression of hypothalamic-pituitary-adrenal (HPA) function	Respiratory inhalation use: 2 inhalations (84–168 µg) TID, QID; maximum dosage, 20 inhalations (840 mcg/d). Intranasal therapy: 1 inhalation (42–84 mcg) in each nostril BID, QID (168–336 mcg/d)
budesonide bue-des'-oh-nide	Pulmicort Respules, Pulmicort Turbuhaler	Turbuhaler: management of chronic asthma in adults and children over age 6; Respules: maintenance treatment of asthma and as prophylactic therapy in children 12 months to 8 years; Additional indication: improvement of symptoms of mild to moderate acute laryngotracheo-bronchitis (croup), seasonal or perennial rhintis (nasal spray)	Oral, laryngeal, pharyngeal irritation, fungal infections, suppression of HPA function	Individualized dosage by oral inhalation Adults: 200–800 mcg BID; children 6 years and older: 200–400 mcg BID; children 12 months to 8 years: 0.5–1 mcg total daily dose administered one or twice daily in divided doses
flunisolide floo-niss'-oh-lide	AeroBid, AeroBid-M	Chronic asthma Respiratory inhalant: asthma Intranasal: rhinitis	Oral, laryngeal, pharyngeal irritation, fungal infections, suppression of HPA function	Adults: 2 inhalations BID; maximum dose, 4 inhalations BID; Intranasal: 2 sprays each nostril BID (maximum dosage, 8 sprays/d)
fluticasone propionate flew-tick'-ah-sone pro'-pee-oh-nate	Flovent, Flovent Rotadisk	Prophylactic maintenance and treatment of asthma	Oral, laryngeal, pharyngeal irritation, fungal infections, suppression of HPA function	Aerosol: 88–880 mcg BID; powder: adults and adolescents 100–1000 mcg BID; children 4–11 years, 500–600 mcg BID
triamcinolone acetonide trye-am-sin'- oh-lone	Azmacort	Maintenance and prophylactic treatment of asthma; for asthma patients who require systemic corticosteroid administration when adding an inhaled corticosteroid may reduce or eliminate the need for systemic corticosteroids	Oral, laryngeal, pharyngeal irritation, fungal infections, suppression of HPA function	Adults: 2 inhalations TID, QID; maximum daily dosage 16 inhalations; children 6–12 years: 1– 2 inhalations TID, QID; maximum daily dosage, 12 inhalations
Leukotriene Receptor Antagonists				
montelukast sodium mon-tell-oo'-kast	Singulair	Prophylaxis and treatment of chronic asthma in adults and children older than 2 years	Headache, dizziness, dyspepsia, gastroenteritis, influenza symptoms, cough, abdominal pain, fatigue	Adults and children older than 15 years: 10 mg PO in the evening; children 6–14 years: 1 5-mg chew- able tablet daily, in the evening; children 2–5 years: 1 4-mg chewable tablet daily, in the evening (continued)

SUMMARY DRUG TABLE ANTIASTHMA DRUGS (Continued)

GENERIC NAME	TRADE NAME	USES	ADVERSE REACTIONS	DOSAGE RANGES
zafirlukast zah-fir'-luh-kast	Accolate	Prophylaxis and treatment of chronic asthma in adults and children 12 years or older	Headache, dizziness, nausea, diarrhea, abdominal pain, vomiting, infection, pain, asthenia, accidental injury, myalgia, fever, ALT elevation	20 mg BID PO
Leukotriene Formati	ion Inhibitors			
zileuton zye-loot'-on	Zyflo	Prophylaxis and treatment of chronic asthma in adults and children 12 years or older	Dyspepsia, nausea, headache, pain, abdominal pain, asthenia, myalgia, accidental injury, ALT elevation	600 mg QID PO
Mast Cell Stabilizers				
cromolyn kroe'-moe-lin	Intal, Nasalcrom	Prophylaxis of severe bronchial asthma; prevention of exercise- induced asthma (EIA) Nasal preparations: prevention and treatment of allergic rhinitis	Dizziness, headache, nausea, dry and irritated throat, rash, joint swelling and pain	Nebulizer solution: 20 mg (1 capsule) inhaled QID Aerosol: adults and children 5 years and older, 2 metered sprays QID Nasal solution: 1 spray each nostril 3–6 times/d Oral: adults and children 13 years and older: 2 ampules QID 30 min before meals and at bedtime; children 2–12 years, 1 ampule QID before meals and at bedtime; do not exceed 40 mg/kg/d
nedocromil nee-doc'-ro-mill	Tilade	Maintenance therapy in mild to moderate bronchial asthma Treatment of itching caused by allergic conjunctivitis (ophthalmic)	Cough, nausea, pharyngitis, rhinitis, vomiting, dyspepsia, chest pain, headache, bronchospasm	2 inhalations QID Eyedrops 1–2 g HS each eye BID

administration of zileuton (Zyflo) include dyspepsia, nausea, abdominal pain, and headache. Liver enzyme elevations may occur with the administration of zileuton. These elevations may continue to rise, remain unchanged, or resolve with continued therapy. Alanine aminotransferase (ALT) is an enzyme produced by the liver that acts as a catalyst in the transamination reaction necessary for amino acid production. ALT is found in liver cells in high concentration. When liver damage occurs, ALT levels increase, which makes ALT testing a valuable test for monitoring liver function.

CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

These drugs are contraindicated in patients with a known hypersensitivity to the drugs. Montelukast, zafirlukast, and zileuton are not used in the reversal of bronchospasm in acute asthma attacks. Zileuton is contraindicated in active liver disease. The drugs are used cautiously in patients with hepatic dysfunction and during pregnancy (zafirlukast and montelukast are Pregnancy Category B drugs, and zileuton is Pregnancy Category C) and lactation.

Administration of zafirlukast and aspirin increases plasma levels of zafirlukast, When zafirlukast is administered with warfarin, there is an increased effect of the anticoagulant. Administration of zafirlukast and theophylline or erythromycin may result in a decreased level of zafirlukast. Administration of montelukast with other drugs has not revealed any adverse responses. Administration of montelukast with aspirin and NSAIDs is avoided in patients with known aspirin sensitivity. Administration of zileuton with propranolol increases the activity or the propranolol; with theophylline increases serum theophylline levels; and with warfarin may increase prothrombin time (PT). A prothrombin blood test should be done regularly in the event dosages of warfarin need to be decreased.

Mast cell stabilizers include cromolyn sodium (Intal) and nedocromil sodium (Tilade).

ACTIONS

These drugs inhibit the release of substances that cause bronchoconstriction and inflammation from the mast cells in the respiratory tract.

USES

The mast cell stabilizers are used in combination with other drugs in the treatment of asthma and other allergic disorders, including allergic rhinitis (nasal solution), and in the prevention of exercise-induced bronchospasm. When the mast cell stabilizers are used in conjunction with other antiasthma drugs, a reduction in dosage of the drugs may be possible after using the mast cell stabilizer for 3 or 4 weeks. These drugs may be given by nebulization, aerosol spray, or as an oral concentrate.

ADVERSE REACTIONS

The more common adverse reactions associated with the mast cell stabilizers include headache, dizziness, nausea, fatigue, hypotension, or unpleasant taste in the mouth. These drugs may cause nasal or throat irritation when given intranasally or by inhalation. A more complete listing of the adverse reactions associated with the mast cell stabilizers is found in the Summary Drug Table: Antiasthma Drugs.

CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

The mast cell stabilizers are contraindicated in patients with known hypersensitivity to the drugs. The mast cell stabilizers are contraindicated in patients during attacks of acute asthma because they may worsen bronchospasm during the acute asthma attack.

It is important to use the mast cell stabilizers cautiously in patients with impaired renal or hepatic function and during pregnancy (Pregnancy Category B) and lactation. No significant drug interactions have been reported.

NURSING PROCESS

 The Patient Receiving a Bronchodilator or an Antiasthma Drug

ASSESSMENT

Preadministration Assessment

Because the bronchodilators or antiasthma drugs may be given for asthma, emphysema, or chronic bronchitis, the preadministration assessment of the patient requires careful observation and documentation. The nurse takes the blood pressure, pulse, and respiratory rate before therapy with a bronchodilator or antiasthma drug is initiated. Respiratory rates below 12/min or above 24/min are considered abnormal. It is important to assess the lung fields and carefully document the sounds heard before therapy is begun. The nurse notes any dyspnea, cough, wheezing (a musical sound of the respiratory tract caused by air passing through a narrowed bronchial tube), "noisy" respirations, or use of accessory muscles when breathing. If the patient is raising sputum, the nurse records a description of the sputum. The nurse notes and records the patient's general physical condition. It is important to record any signs of hypoxia (eg, mental confusion, restlessness, anxiety, and cyanosis [bluish discoloration of the skin and mucous membranes]). In some instances the primary heath care provider may order arterial blood gas analysis or pulmonary function tests.

In patients with chronic asthma, question the patient concerning allergies, frequency of attacks, severity of attacks, factors that cause or relieve attacks, and any antiasthma drugs used currently or taken previously.

Ongoing Assessment

During the ongoing assessment, the nurse assesses the respiratory status every 4 hours and whenever the drug is administered. The nurse notes the respiratory rate, lung sounds, and use of accessory muscles in breathing. In addition, the nurse keeps a careful record of the intake and output and reports any imbalance, which may indicate a fluid overload or excessive diuresis. It is important to monitor any patient with a history of cardiovascular problems for chest pain and changes in the electrocardiogram. The primary health care provider may order periodic pulmonary function tests, particularly for patients with emphysema or bronchitis, to help monitor respiratory status.

After administration of the drug, the nurse observes the patient for the effectiveness of drug therapy. Breathing should improve, and the patient will appear less anxious. If relief does not occur, the nurse notifies the primary health care provider because a different drug or an increase in dosage may be necessary. The nurse observes the patient for adverse drug reactions. If adverse reactions occur, the nurse withholds the next dose and contacts the primary health care provider.

Occasionally the patient may experience an acute bronchospasm either as a result of the disease, after exposure to an allergen, or as an adverse reaction to some antiasthma drugs, such as cromolyn inhalation.

An inhaled sympathomimetic, such as albuterol, may be prescribed initially. Salmeterol, a long-acting β -agonist, is contraindicated because of its slowed onset of action. During an acute bronchospasm, the nurse checks the blood pressure, pulse, respiratory rate, and response to the drug every 15 to 35 minutes until the patient's condition stabilizes and respiratory distress is relieved.

Nursing Alert

Acute bronchospasm causes severe respiratory distress and wheezing from the forceful expiration of air and is considered a medical emergency. It is characterized by severe respiratory distress, dyspnea, forceful expiration, and wheezing. The nurse must report these symptoms to the primary health care provider immediately.

NURSING DIAGNOSES

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

PLANNING

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

Nursing Diagnoses Checklist

- Ineffective Airway Clearance related to narrowed airway passages, thick or excessive mucus
- ✓ Ineffective Breathing Pattern related to narrowed airway passage, thick or excessive mucus
- Risk for Impaired Oral Mucous Membrane related to adverse reactions of the bronchodilating and antiasthma inhalants
- Anxiety related to adverse reactions of the bronchodilators (sympathomimetic drugs)

IMPLEMENTATION

Promoting an Optimal Response to Therapy

Nursing care of the patient receiving a bronchodilating drug or an antiasthma drug requires careful monitoring of the patient and proper administration of the various drugs. These drugs may be given orally, parenterally, or topically by inhalation or nebulization (see Chap. 2). In general, the nurse gives the drugs around the clock to maintain therapeutic blood levels. If the drug is to be administered once a day, the nurse should give it in the morning. Dosages are individualized for each patient, which allows the smallest effective dose to be given. The nurse can give oral preparations with food or milk if gastric upset occurs.

If the nurse is responsible for administering the medication by nebulization, it is important to place the patient in a location where he can sit comfortably for 10 to 15 minutes. The compressor is plugged in and the medication mixed as directed, or the prepared unit dose vial is emptied into the nebulizer. Different types of medication are not mixed without checking with the physician or the pharmacist. The mask or mouthpiece is assembled and the tubing connected to the compressor. The patient is placed in a comfortable, upright position with the mask over the nose and mouth. The mask must fit properly so that the mist does not flow up into the eyes. If using a mouthpiece instead of a mask, have the patient place the mouthpiece into the mouth. The compressor is turned on and the patient instructed to take slow, deep breaths. If possible, the patient should hold his breath for 10 seconds before slowly exhaling. The treatment is continued until the medication chamber is empty. After treatment, the mask is washed with hot, soapy water, rinsed well, and allowed to air dry.

PATIENTS TAKING SYMPATHOMIMETICS. Some of the sympathomimetics are extremely potent drugs. The nurse exercises great care in reading the primary health care provider's order when preparing these drugs for administration. Doses of drugs such as epinephrine are measured in tenths of a milliliter. A tuberculin syringe is used for measuring and administering these drugs by the parenteral route.

The nurse may administer epinephrine subcutaneously for an acute bronchospasm. Therapeutic effects occur within 5 minutes after administration and last as long as 4 hours.

Salmeterol is a long-acting inhaled bronchodilator and is not used to treat acute asthma symptoms. It does not replace the fast-acting inhalers for sudden symptoms. Salmeterol should not be used more frequently than twice daily (morning and evening).

Formoterol fumarate (Foradil Aerolizer) is administered only by oral inhalation using the Aerolizer Inhaler.

The usual dosage is one 12- μ g capsule of formoterol every 12 hours. When using the Aerolizer Inhaler, the patient must not exhale into the device. When beginning treatment with this drug, the patient is instructed to discontinue the regular use of the short-acting β_2 -agonist and use that agent only for relief of acute asthma symptoms.

PATIENTS TAKING XANTHINE DERIVATIVES. For acute respiratory symptoms, rapid theophyllinization using one of the xanthine derivatives may be required. **Theophyllinization** is accomplished by giving the patient a higher initial dose, called a loading dose, to bring blood levels to a therapeutic range more quickly than waiting several days for the drug to exert a therapeutic effect. The nurse may give loading doses orally or intravenously (IV) during a period of 12 to 24 hours. It is important to closely monitor the patient for signs of theophylline toxicity. See "Monitoring and Managing Adverse Reactions."

For patients receiving a xanthine derivative such as theophylline, the dosage is individualized and based on improvement of the patient's condition and serum theophylline drug levels.

The nurse can give some of these drugs (for example, aminophylline or theophylline) IV, either direct IV or as an IV infusion. When giving theophylline or aminophylline IV, the nurse monitors the patient for hypotension, cardiac arrhythmias, and tachycardia. If a bronchodilator is given IV, the nurse administers it through an infusion pump. The nurse checks the IV infusion site at frequent intervals because these patients may be extremely restless, and extravasation can occur.

If theophylline or another xanthine derivative is given as a rectal suppository, the nurse checks the patient every 15 to 30 minutes to be sure the suppository has been retained. If the patient is unable to retain the suppository, the nurse contacts the primary health care provider because another route of administration may be necessary.

When immediate-release products are used, the nurse administers the drug every 6 hours. In some adults, intervals of 8 hours between dosing may be satisfactory.

PATIENTS TAKING LEUKOTRIENE RECEPTOR ANTAGONISTS AND LEUKOTRIENE FORMATION INHIBITORS. The nurse should never administer these during an acute asthma attack. These agents are used for the management of chronic asthma and are not bronchodilators. If used during an acute attack, these drugs may worsen the attack.

These drugs are administered orally. Montelukast is administered once daily in the evening; zafirlukast is administered twice daily 1 hour before meals or 2 hours after meals. Zileuton is administered four times daily.

PATIENTS TAKING CORTICOSTEROID INHALANTS. If the patient is receiving a sympathomimetic bronchodilator by inhalation and a corticosteroid such as triamcinolone by inhalation, the nurse administers the bronchodilator first, waits several minutes, then administers the corticosteroid inhalant. When administering two inhalations of the same drug, it is advisable to wait at least 1 minute between puffs.

PATIENTS TAKING MAST CELL STABILIZERS. The mast cell stabilizers, such as cromolyn (Intal), may be added to the patient's existing treatment regimen (eg, bronchodilators). When added to the existing regimen, the other medications (ie, corticosteroids) are decreased gradually when the patient experiences a therapeutic response to cromolyn (2–4 weeks) and asthma is under good control. The corticosteroids or other antiasthma drugs may be reinstituted based on the patient's symptoms. If use of the mast cell stabilizers must be discontinued for any reason, the dosage is gradually tapered.

When administered orally, cromolyn is given 1/2 hour before meals and at bedtime. The oral form of the drug comes in an ampule. The ampule is opened and the contents poured into a glass of water. The nurse stirs the mixture thoroughly. The patient must drink all of the mixture. The drug may not be mixed with any other substance (eg, fruit juice, milk, or foods).

The drugs may be administered by a metered-dose inhaler (see Patient and Family Teaching Checklist: Teaching the Patient to Use a Metered-Dose Inhaler). If an aerosol inhalator is used for administration, the nurse teaches the patient how to use this method of delivering the drug to the lungs.

When a therapeutic response occurs, the dosage may be reduced to a maintenance dose.

Monitoring and Managing Adverse Reactions

SYMPATHOMIMETIC DRUGS. Patients who have difficulty breathing and are receiving a sympathomimetic drug may experience extreme anxiety, nervousness, and restlessness, which may be caused by their breathing difficulty or the action of the sympathomimetic drug. In these patients, it may be difficult for the primary health care provider to determine if the patient is having an adverse drug reaction or if the problem is related to the respiratory disorder. The nurse can reassure the patient that the drug being administered will most likely relieve the respiratory distress in a short time. Patients who are extremely apprehensive are observed more frequently until their respirations are near normal. The nurse closely monitors the patient's blood pressure and pulse during therapy and reports any significant changes. The nurse speaks and acts in a calm manner, being careful not to increase the anxiety or nervousness caused by the sympathomimetic drug. Explaining the effects of the



Patient and Family Teaching Checklist

Teaching the Patient to Use a Metered-Dose Inhaler

To properly instruct the patient in administration of drug via a metered-dose inhaler, the nurse must be aware of general instructions for use for all metered-dose inhalers and three common methods of use: holding the lips around the mouthpiece, holding the inhaler away from the mouth, and using a spacer or extender.

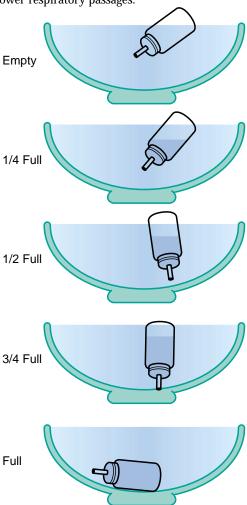
General Instructions for Use for All Metered-Dose Inhalers

The nurse teaches the patient to:

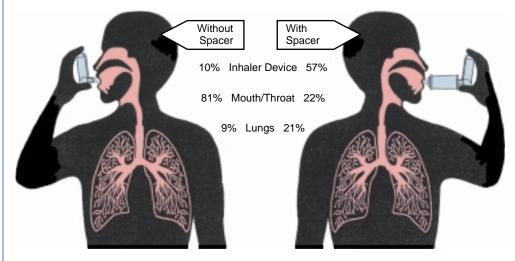
- ✓ Shake the inhaler well, with the canister in place, for 5 to 10 seconds immediately before use.
- Remove the cap from the mouthpiece.
- Breathe out to the end of a normal breath.
- Hold the inhaler system upright.
- ✓ Place the mouthpiece into the mouth, close the lips tightly **or** position the mouthpiece 2 to 3 fingerwidths from open mouth and tilt the head back.
- Activate the inhaler while taking a slow, deep breath for 3 to 5 seconds.
- ✓ Hold the breath for about 10 seconds and exhale slowly.
- ✓ If more than one inhalation is required, wait about 1 minute between inhalations (see manufacturer's directions for specific times). Two minutes are allowed between inhalations for metaproterenol.
- Gargle or rinse the mouth after each dose to relieve dry mouth and throat irritation.
- Rinse the extender and mouthpiece, if applicable, daily in warm water and store them away from heat.
- To monitor the amount of drug remaining in the canister, test the canister by placing it in a container of water.

Holding the Inhaler Away From the Mouth. This method involves the use of a device called an extender or spacer attached to the inhaler. Use of the extender allows more drug to reach the lung. The nurse teaches the patient to:

- ✓ Place the extender over the mouth (see manufacturer's directions for specific directions).
- Press the chamber.
- ✓ When the drug passes through the extender, take four to six deep breaths to deliver the drug to the lower respiratory passages.



To monitor the amount of drug in a metered-dose inhaler, you can periodically place the canister in a container of water. The figure shows the positioning of the canister with various amounts of medication remaining in the canister. (Adapted from the American Lung Association. [1993]. *Understanding lung medications: How they work—how to use them,* p. 4)



Drug dispersion using a metered dose-inhaler with and without a spacer. (Adapted from the American Lung Association. [1993]. *Understanding lung medications: How they work—how to use them,* p. 5)

drug may help the patient to tolerate these uncomfortable adverse reactions.



Gerontologic Alert

Older adults taking the sympathomimetic bronchodilators are at increased risk for adverse reactions related to the cardiovascular system (tachycardia, arrhythmias, palpitations, and hypertension) as well as adverse reactions related to the central nervous system (restlessness, agitation, insomnia).



Large doses of IV albuterol or IV terbutaline may aggravate diabetes mellitus. Diabetic patients may require an increase in insulin dosage or oral hypoglycemic drug.

XANTHINE DERIVATIVES. The patient taking theophylline may report heartburn because the drug relaxes the lower esophageal sphincter, allowing gastroesophageal reflux. Heartburn is minimized if the patient remains in an upright position and sleeps with the head of the bed elevated.

When the patient is taking theophylline, the nurse must monitor frequently for signs of toxicity. A daily plasma theophylline level is useful in monitoring for toxicity. The nurse should arrange to obtain serum blood samples to measure theophylline levels at the time of peak absorption, 1 to 2 hours after administration for immediate-release products and 5 to 9 hours after the morning dose for most sustained-released preparations. The patient should not have missed any doses during the previous 48 hours. The nurse should discourage the patient from drinking coffee before blood is drawn to determine the blood theophylline level because this can cause a false elevation of drug concentration levels.

The therapeutic range of theophylline blood levels is 10 to 20 μg/mL. Levels greater than 20 μg/mL may cause toxicity. In some patients, toxicity may occur with levels between 15 and 20 µg/mL. Toxicity is more likely to occur in patients requiring high doses or during prolonged therapy.

Display 37-1 identifies symptoms observed in patients with various serum theophylline levels.

The nurse reports any serum theophylline levels greater than 20 µg/mL or any symptoms associated with toxicity.



Notify the primary health care provider immediately if any of the following signs of theophylline toxicity develop: anorexia, nausea, vomiting, diarrhea, confusion, abdominal cramping, headache, restlessness, insomnia, tachycardia, arrhythmias, or seizures.

DISPLAY 37-1 • Symptoms Associated With Serum Theophylline Levels

- Levels less than 20 mcg/mL—adverse reactions are rare
- Levels greater than 20 mcg/mL—nausea, vomiting, diarrhea, headache, insomnia, irritability
- Levels greater than 35 mcg/mL—hyperglycemia, hypotension, cardiac arrhythmias, tachycardia, seizures, brain damage
- Levels greater than 40 mcg/mL—seizures and cardiorespiratory arrest

ANTIASTHMA DRUGS. Some antiasthma drugs may cause an unpleasant taste in the mouth. Having the patient take frequent sips of water, suck on sugarless candy, or chew gum helps to alleviate the problem. If dizziness occurs, the patient may require assistance with ambulation. For nausea, the nurse provides frequent small meals, rather than three larger meals.

CORTICOSTEROID INHALANTS. The inhalers, particularly the corticosteroid or mast cell aerosols, may cause throat irritation and infection with Candida albicans. The nurse instructs the patient to use strict oral hygiene, cleanse the inhaler as directed in the package directions, and use the proper technique when taking an inhalation. These interventions will decrease the incidence of candidiasis and help to soothe the throat. Occasionally an antifungal drug may be prescribed by the primary health care provider to manage the candidiasis.

Nursing Alert

Bronchospasm may occur after administration of the inhaled corticosteroids. If an immediate increase in wheezing indicating bronchospasm occurs after administration of a corticosteroid inhalant, the nurse immediately administers a shortacting inhaled bronchodilator. The inhaled corticosteroid is discontinued and an alternate treatment started.

LEUKOTRIENE RECEPTOR AGONISTS AND LEUKOTRIENE FORMATION INHIBITORS. The nurse carefully monitors hepatic transaminase levels at the beginning of treatment and during therapy with zileuton. ALT levels are taken before treatment begins, once a month for the first 3 months, then every 2 to 3 months for the remainder of the first year. After the first year, ALT levels are measured periodically. If symptoms of liver impairment (such as right upper quadrant pain, nausea, fatigue, lethargy, pruritus, jaundice, or "flu-like" symptoms) occur or the ALT elevation is greater than 5 times the upper limits of normal, use of the drug is discontinued. Transaminase levels are monitored until they return to normal.

Educating the Patient and Family

If the patient is to use an aerosol inhalator for administration of the bronchodilator, the nurse provides a



Home Care Checklist

USING A PEAK FLOW METER

Patients receiving bronchodilators or antiasthma drugs often need to monitor their lung function at home with a peak flow meter. Doing so provides the patient and the physician with valuable information about the status of the patient's condition and the effectiveness of therapy. Often, trends in the readings can detect changes in the patient's airway and airflow even before any signs and symptoms are experienced. This allows possible intervention before a major problem arises.

Because a variety of meters are commercially available, the nurse explains about the type of meter that will be used, how often the peak flow should be checked, and the ranges for the readings along with instructions on what to do for each range. The nurse uses the following steps to instruct the patient on the use of the peak flow meter:

V

Check to make sure that the indicator is at the lowest level of the scale.

V

Stand upright to allow the best inhalation possible. (Be sure to remove gum or food from your mouth.)

1

Inhale as deeply as you can and then place your lips around the mouthpiece, making sure that you have a tight seal.



Exhale as forcibly and as quickly as possible in one large "huff."

1

Watch the indicator rise on the scale, noting where it stops. The number below the indicator's position is your peak flow reading.



Repeat the procedure two more times.



Compare the three readings. Record the highest reading along with the date and time. Do not calculate an average.



Keep a written record of your readings and bring it with you on follow-up visits.



Measure the peak flow rate close to the same time each day. (Your physician may provide you with a suggested time. Some patients measure the peak flow rate twice daily between 7 and 9 AM and between 6 and 8 PM. Others measure the peak flow rate before or after taking their medication.)



Follow the medication instructions written on your record sheet next to the zone color of your reading (see Display 37-2) provided by your physician.



Clean your meter with mild soap and hot water after use.

thorough explanation of its use (see Patient and Family Teaching Checklist: Teaching the Patient to Use a Metered-Dose Inhaler).



Nursing Alert

The nurse should not assume that the patient understands how to use an aerosol inhaler correctly. Many patients, even with repeated instruction, do not use the proper technique to administer the drug by inhalation. Along with verbal instructions, the nurse should have the patient demonstrate the use of the inhaler to evaluate if he or she is using the proper technique. It is important to repeat instructions at each follow-up visit.

Because each brand is slightly different, the nurse carefully reviews any instruction sheets with the patient and provides information about how the unit is assembled, used, and cleaned. In addition, the patient may use a peak flow meter at home to monitor the effectiveness of the drug regimen or breathing status. The nurse teaches the patient how to use the peak flow meter and when to notify the primary health care provider (see Home Care Checklist: Using a Peak Flow Meter). A commonly used method to interpret peak flow rates is to relate the three zones to the traffic light colors: green, yellow, and red. See Display 37-2 for information about the three-zone system. The physician may give the patient an action plan to determine what action to take for each of the three zones (see Fig. 37-3).

The nurse also includes the following general points in the patient teaching plan:

- Take the drug exactly as prescribed by the primary health care provider.
- If symptoms become worse, do not increase the dose or frequency of use unless directed to do so by the primary health care provider.

DISPLAY 37-2 • Monitoring Peak Flow Readings

Many primary care health providers recommend a three-zone system. This system is based on your personal best peak flow rate—the highest peak flow measurement you can achieve on a day when your asthma is under good control—and it divides peak flow readings into three zones. The green zone ranges from 80% to 100%* of your personal best. The yellow zone, from 50% to 80%*. And the red zone is anything below 50%*.

These percentages are given as an example. Your doctor will tailor your zones to your individual needs and peak flow patterns.

THINK OF THESE ZONES AS TRAFFIC SIGNALS



 Green means "go." Continue your regular activities and follow your maintenance asthma medication plan.



 Yellow means "caution." Additional medication may be needed (either for an acute episode, or if your condition remains stable, as part of your maintenance plan).



 Red means "stop." This is a danger zone. Notify the primary care health provider immediately. Use the medication prescribed when peak flow readings indicate that asthma is not in good control.

The goal is to stay in the green zone as long as possible and to take action whenever you enter the yellow zone, so you **never** enter the red zone. The primary care health provider will adjust the color-coded zone indicators on your personal best peak flow meter to remind you of your red, yellow, and green zones, as well as fill out your action plan with your medication instructions.

- If gastrointestinal upset occurs, take this drug with food or milk (oral form).
- Drink 6 to 8 glasses of water each day to decrease the thickness of secretions.
- Do not use nonprescription drugs (some may contain sympathomimetic drugs) unless use has been approved by the primary health care provider.
- Avoid smoking (when applicable). Smoking may make it difficult to adjust the dosage and may worsen breathing problems.
- Do not puncture metered dose inhalers or store them near heat or open flame; the contents of such inhalers are under pressure. Never throw the container into a fire or incinerator. If an unusual smell or taste is noted with use of the inhaler, discontinue use and contact the primary care provider.

SYMPATHOMIMETICS

- Do not exceed the recommended dosage.
- These drugs may cause nervousness, insomnia, and restlessness (especially the sympathomimetics).
 Contact the primary health care provider if the symptoms become severe.
- Contact the primary care provider if palpitations, tachycardia, chest pain, muscle tremors, dizziness, headache, flushing, or difficulty with urination or breathing occur.

- Salmeterol is not meant to relieve acute asthmatic symptoms. Notify the physician immediately if salmeterol becomes less effective for symptom relief, if more inhalations than usual are needed, or if more than the maximum number of inhalations of shortacting bronchodilators are needed.
- Formoterol fumarate (Foradil Aerolizer) is administered only by oral inhalation using the Aerolizer Inhaler. When using the Aerolizer Inhaler, do not exhale into the device. Always store formoterol capsules in the blister and remove immediately before use. Always discard the capsule and Aerolizer Inhaler by the expiration date included in the manufacturer's instructions. When treatment with formoterol begins, discontinue the regular use of the short-acting β_2 -agonist and use it only for relief of acute asthma symptoms. Do not substitute formoterol for inhaled oral corticosteroids and do not reduce the use of the corticosteroids.

XANTHINE DERIVATIVES

- Remember that frequent monitoring of theophylline serum levels is important.
- Avoid foods that contain xanthine, such as colas, coffee, chocolate, and charcoal-prepared foods.
- If gastrointestinal upset occurs, take the drug with food. Do not chew or crush coated or sustainedrelease tablets.
- Do not change from one brand to another without consulting your physician.

CORTICOSTEROID INHALANTS

- Corticosteroid Inhalant—Rinse mouth with water without swallowing after each dose to reduce the risk of oral candidiasis. Carry a warning card indicating the need for supplemental systemic steroids in the event of stress or severe asthmatic attack that is unresponsive to bronchodilators. Do not stop therapy abruptly. These drugs are not bronchodilators and do not contain medication to provide rapid relief of breathing difficulties during an asthma attack. If taking bronchodilators by inhalation, use the bronchodilator several minutes before the corticosteroid to enhance application of the steroid into the bronchial tract. See Patient and Family Teaching Checklist: Teaching the Patient to Use a Metered-Dose Inhaler.
- Corticosteroid Inhaled Powder—Hold the inhaler upright and twist off the cover. Twist the grip to the right as far as it will go, listen for the click, and then twist it back. Exhale and place the mouthpiece between lips; slightly tilt head back and inhale deeply and forcefully. Remove inhaler from the mouth and hold breath for about 10 seconds. Rinse the mouth with water after each use to help reduce dry mouth and hoarseness.

ASTHMA ACTION PLAN FOR	Doctor's Name Date Date
Doctor's Phone Number	Hospital/Emergency Room Phone Number
GREEN ZONE: Doing well	Take These Long-Term-Control Medicines Each Day (Include an anti-inflammatory)
No cough, wheeze, chest tightness, or shortness of breath during the day or night Can do usual activities	Medicine How much to take When to take it
And, if peak flow meter is used, Peak flow: more than (80% or more of my best peak flow)	
My best peak flow is:	
Before exercise	2 or 4 puffs 5 to 60 minutes before exercise
YELLOW ZONE: Asthma is getting well Cough, wheeze, chest tightness, or shortness of breath, or Waking at night due to asthma, or Can do some, but not all, usual activities -Or- Peak flow: to (50%-80% of my best peak flow)	Add: Quick-Relief Medicine—and keep taking your GREEN ZONE medicine (short-acting beta2-agonist)
RED ZONE: Medical Alert! Very short of breath, or Quick-relief medicines have not helped, or Cannot do usual activities, or Symptoms are same or get worse after 24 hou in Yellow Zone -Or- Peak flow: less than	Take this medicine:
 ■ Trouble walking and talking due to shortness of Lips or fingernails are blue 	of breath

LEUKOTRIENE RECEPTOR AGONISTS AND LEUKOTRIENE FORMATION INHIBITORS

- Zafirlukast—Take this drug regularly as prescribed, even during symptom-free times. Do not use to treat acute episodes of asthma.
- Montelukast—Take once daily in the evening, even when free of symptoms. Contact physician if the asthma is not well controlled. This drug is not for the treatment of an acute attack. Avoid taking aspirin and the NSAIDs while taking montelukast.
- Zileuton—This drug is not a bronchodilator, so do not use it for an acute episode of asthma. Contact the physician if bronchodilators are needed more often than usual or if more than the maximum number of inhalations for a 24-hour period is needed. This drug can interact with other drugs; consult a physician before starting or stopping any prescription or nonprescription drug. Have liver enzyme tests monitored on a regular basis. Immediately report any symptoms of liver dysfunction, such as upper right quadrant pain, nausea, fatigue, lethargy, pruritus, and jaundice.

MAST CELL STABILIZERS

- Inform the primary health care provider if asthma symptoms do not improve within 4 weeks of initiating treatment. The primary health care provider may discontinue the drug therapy.
- Cromolyn—When taken to prevent exercise-induced asthma, this drug should be taken approximately 15 minutes before activity but no earlier than 1 hour before the expected activity.
- Cromolyn—When taken orally, this drug should be taken at least 30 minutes before meals and at bedtime. The drug is prepared by opening the ampule and squeezing the liquid contents into a glass of water. The nurse stirs the solution, and the patient is instructed to drink the entire amount. Do not mix the drug with any other food or beverage.

EVALUATION

- The therapeutic effect is achieved, and breathing is easier and more effective.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully.
- The patient demonstrates an understanding of the drug regimen and use of the nebulizer or aerosol inhalator.

Critical Thinking Exercises

 Mr. Potter, age 57 years, is admitted to the pulmonary unit in acute respiratory distress. The primary health care provider orders IV aminophylline. In developing a care plan for Mr. Potter, you select the nursing diagnosis Ineffective Airway Clearance. Suggest nursing interventions that would be most important in managing this problem.

- 2. Ms. Smith, age 68 years, returned to the clinic for a follow-up visit after receiving a diagnosis of COPD. She is taking theophylline daily and using a metered-dose inhaler 4 times a day. Determine what assessments would be most important for you to make at this time.
- 3. Discuss what to include in a teaching plan for a patient taking montelukast for asthma.

Review Questions

- 1. Which of the following laboratory exams would the nurse expect to be ordered for a patient taking aminophylline?
 - A. Thyroid levels
 - B. Alanine aminotransferase
 - C. Electrolytes
 - D. Serum aminophylline levels
- 2. When the sympathomimetics are administered to older adults there is an increased risk of _____.
 - A. gastrointestinal effects
 - B. nephrotoxic effects
 - C. neurotoxic effects
 - D. cardiovascular effects
- 3. When zileuton is prescribed, the nurse expects which laboratory test to be checked periodically?
 - A. Urine for culture and sensitivity (C&S)
 - B. Complete blood count (CBC)
 - C. Prothrombin test (PT)
 - D. Alanine aminotransferase (ALT)
- 4. When administering aminophylline, a xanthine derivative bronchodilating drug, the nurse monitors the patient for adverse reactions, which include _____.
 - A. restlessness, nervousness
 - B. hypoglycemia, hypothyroidism
 - C. bradycardia, bronchospasm
 - **D.** somnolence, lethargy
- 5. The nurse correctly administers montelukast (Singulair) _____.
 - A. once daily in the evening
 - B. twice daily in the morning and evening
 - C. three times a day with meals
 - D. once daily in the morning

Medication Dosage Problems

- 1. A patient is to have 0.25 mg of terbutaline SC. The drug is available for injection in a solution of 1 mg/mL. The nurse administers _____.
- 2. The patient is prescribed zafirlukast 20 mg PO BID. The drug is available in 10-mg tablets. The nurse administers _____. How many milligrams of zafirlukast will the patient receive each day?