SHORT-ACTING INHALED BETA2 AGONISTS

Generic Name	Brand Name	Dosage Forms; Dosing & Administration	Shaking and Priming Instructions	Cleaning Instructions	Sprays/ Inhalations per each unit	Potential side effects and nursing considerations
Albuterol Sulfate HFA	ProAir® HFA Proventil® HFA Ventolin® HFA	MDI: 90 mcg/ spray 1-2 inhalations every 4-6 hours or 15-30 minutes before exercise.	Shake all. ProAir® spray 3 times and Proventil® & Ventolin® spray 4 times before first use or after 2 weeks of non-use. For Ventolin®, must also be primed [4 sprays] after dropping.	Once a week remove canister and rinse plastic actuator with warm water; air dry.	ProAir® and Proventil® 200 sprays Ventolin® HFA is available in 204 sprays and 60 sprays	Use at first signs of asthma symptoms or prior to exercise. Ventolin® HFA has a dose counter on all units.
Albuterol sulfate inhalation solution	Unit dose vials of albuterol 0.083% comes as generic. Albuterol sulfate 0.5% Accuneb	One unit dose vial, every 4 to 6 hours Dose will vary. every 4 to 6 hours 0.63 mg and 1.25 mg in 3 mL unit-dose vials; every 4 to 6 hours				Vials do not require dilution. For use in a compressor or nebulizer. These are concentrated albuterol. They need to be diluted in saline before use.
Levalbuterol HCL	Xopenex® HFA Xopenex inhalation solution	MDI: 45 mcg/ spray 1-2 inhalations every 4 to 6 hrs Xopenex: 0.31 mg; 0.63 mg; 1.25 mg in 3 mL unit-dose vials; one vial every 6 to 8 hours.	MDI: Shake and spray 4 times before first use or after 3 days non-use.	Once a week remove canister and rinse plastic actuator with warm water; air dry.	80 or 200 sprays Solution: Store in the foil pouch. Once the foil pouch is opened use the vials within two weeks.	Xopenex inhalation solution also available concentrate of 1.25mg in 0.5ml (need to dilute).

For children frequently using SABAs, anti-inflammatory medication should be initiated or intensified.

Side effects of short acting beta agonists include tremor, tachycardia, headache, restlessness, apprehension, anxiety, nausea, sweating, and flushing. If a maximum dose is exceeded, sympathomimetic cardiac effects can occur. Chronic daily use may lead to worsening asthma and decreased pulmonary function. The need for more than two refills a year indicates poor asthma control and need for increased long-term medications.

Asthma Ready Communities (2010)

ANTICHOLINERGIC MEDICATIONS

Anticholinergic medications cause bronchodilation by blocking vagally mediated reflexes and antagonizing the action of acetylcholine. These medications are used in combination with short acting bronchodilators to open large airways and reduce mucus.

Generic Name	Brand Name	Dosage Forms; Dosing & Administration	Shaking and Priming Instructions	Cleaning Instructions	Capsules/ Sprays/ Inhalations per each unit	Potential side effects and nursing considerations
Ipratropium bromide	Atrovent® HFA	MDI: 17 mcg/ spray 2 inhalations 4 times a day	Do not shake. Spray 2 times before first use or after 3 days non-use.	Once a week remove canister and rinse plastic actuator with warm water; air dry.	200 sprays	
Ipratropium bromide	Atrovent®	**Nebulizer:** 0.20 mg/ml (0.02% in 2.5 ml) **Dose**: ½ vial <12 years; 1 vial >12 years Q4 hr prn				
Tiotropium Bromide	Spiriva® HandiHaler	DPI: 18 mcg/ capsule 1 inhalation Once a day	Do not shake or prime.	Clean mouth-piece with moist tissue; once a month open device fully and rinse with warm water; air dry for 24 hours	30 or 90 capsules	This medication is NOT approved for the treatment of asthma.

Therapeutic Issues related to Ipratropium bromide:

- May block reflex bronchoconstriction secondary to irritants or to reflux esophagitis.
- Side effects include dry mouth, headache, dizziness, blurred vision, rash, and GI upset.
- May be an alternative for patients who do not tolerate SABA (short acting beta agonist).
- Treatment of choice for bronchospasm due to beta blocker medication.

LEUKOTRIENE MODIFIERS

These oral medications alter the effects of leukotriene, an airway inflammatory mediator. In the treatment of asthma, these medications are not as effective as inhaled corticosteroids. As an addition to a regimen of inhaled corticosteroids, leukotriene modifiers are less effective than adding a long-acting beta agonist. Montelukast is approved for the treatment of asthma and allergy, so these medications are sometimes a helpful addition to the medication regimen.

Generic Name	Brand Name	Dosage Forms	Dosing & Administration	Potential side effects and nursing considerations
Montelukast	Singulair®	4 mg granules (12-23 months) Tablet: 4 mg chewable (2-5 years old) 5 mg chewable (6-14 years old) 10 mg tablet (15 years & older)	1 packet sprinkled on soft food. 1 tablet in the evening. AM dosing optional to aid exercised induced asthma.	Dizziness, headache, rash, nausea, and vomiting (all are rare) Psychiatric disorders: agitation, anxiousness, depression, insomnia, irritability, restlessness, suicidal thinking and behavior
Zafirlukast	Accolate®	Tablet: 10 mg, 20 mg	Age 5-11: one 10 mg tablet twice daily Age 12 and older: one 20 mg tablet twice daily	Take one hour before meals or two hours after meals (administration with meals decreases bioavailability) Can inhibit the metabolism of warfarin. INRs should be monitored during coadminstration. Can raise liver enzymes, measure these before first use and periodically during use.
Zileuton	Zyflo® CR tablets	Tablet: 600 mg	Age 12 and older; Two 600 mg tablets twice daily within 1 hour of meals.	Attention to drug interactions (especially warfarin and theophylline). Can raise liver enzymes, measure these before first use and periodically during use.

DO NOT USE LEUKOTRIENE MODIFIER + LONG ACTING BETA AGONIST AS A SUBSTITUTE FOR INHALED CORTICOSTEROID + LONG ACTING BETA AGONIST.

LONG-ACTING BETA-2 AGONISTS

Long-acting beta agonists (LABA) bind to beta 2 receptors in the lungs. LABA blocks bronchoconstriction by interfering with endogenous adrenergic pathways in the airways.

Generic Name	Brand Name	Dosage Forms	Shaking and Priming Instructions	Cleaning Instructions	Capsules/ Inhalations per each unit	Potential side effects and nursing considerations
Salmeterol Delayed onset (30 minutes) sustained effect for 10-12 hours	Serevent®	DPI: 50 mcg/ blister	Do not shake or prime.	Do not wash or take apart; keep dry.	60 inhalations	Tachycardia, tremor, palpitations. Should not be used in place of anti-inflammatory therapy. Do not use to treat sudden episodes of asthma symptoms.
Formeterol Immediate onset, sustained effect for 10-12 hours	Foradil®	DPI: 12 mcg capsules for inhalation	Do not shake or prime.	Do not wash or take apart; keep dry.	60 capsules	Tachycardia, tremor, palpitations. Should not be used in place of anti-inflammatory therapy. Do not use to treat sudden episodes of asthma symptoms.

The U.S. Food and Drug Administration announced February 2010 that drugs in the class of long-acting beta agonists (LABAs) should never be used alone in the treatment of asthma in children or adults. These new requirements are based on FDA analyses of clinical trials showing that use of these long-acting medicines is associated with an increased risk of severe worsening of asthma symptoms, leading to hospitalization in both children and adults and death in some patients with asthma.

Product labels are required to reflect the following: 1) The use of LABAs is contraindicated without the use of an asthma controller medication such as inhaled corticosteroid. Single-agent LABAs should only be used in combination with an asthma controller medication; they should not be used alone; 2) LABAs should only be used long-term in patients whose asthma cannot be adequately controlled on asthma controller medications; 3) LABAs should be used for the shortest duration of time required to achieve control of asthma symptoms and discontinued, if possible, once asthma control is achieved. Patients should then be maintained on an asthma controller medication. 4) Pediatric and adolescent patients who require a LABA in addition to an inhaled corticosteroid should use a combination product containing both an inhaled corticosteroid and a LABA to ensure compliance with both medications.

(http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm200931.htm)

Long-Acting Beta Agonist (LABA) Information
http://www.fda.gov/Drugs/DrugSafety/InformationbyDrugClass/ucm199565.htm

COMBINATION MEDICATIONS

These medications combine a long-acting beta2-agonist with an inhaled corticosteroid.

Generic Name	Brand Name	Dosage Forms	Shaking and Priming Instructions	Cleaning Instructions	Sprays/ Inhalations per each unit	Potential side effects and nursing considerations
Fluticasone Propionate with Salmeterol	Advair® HFA	MDI: (mcg fluticasone/ mcg salmeterol) 45/21; 115/21; 230/21	Shake (5 seconds) and spray 4 times before first use; spray 2 times after dropping or after 4 weeks non-use.	Once a week, clean exit port with dry cotton swab, wipe mouthpiece with damp tissue, air dry.	120 sprays	Same as listed for long-acting beta agonists- see pages on these medications.
Fluticasone Propionate with Salmeterol	Advair® Diskus	DPI: (mcg fluticasone/ mcg salmeterol)	Do not shake or prime.	Do not wash or take apart; keep dry.	60 inhalations	Same as listed for long-acting beta agonists- see pages on these medications.
Budesonide with Formoterol	Symbicort® HFA	MDI: (mcg budesonide/ mcg formoterol) 80/4.5; 160/4.5	Shake (5 seconds) and spray 2 times before first use, after dropping and after 7 days non-use.	Once a week, wipe mouth-piece with dry cloth; do not use water.	120 sprays	Same as listed for long-acting beta agonists- see pages on these medications.
Mometasone Furoate with Formoterol	Dulera® HFA (new 2010)	MDI: (mcg mometasone/ mcg formoterol 100/5; 200/5	Shake (5 seconds) and spray 4 times before first use, and spray 4 times after 5 days non-use.	Once a week, wipe mouth-piece with dry cloth; do not use water.	120 sprays	Same as listed for long-acting beta agonists- see pages on these medications.

CAUTION: Persons on medicines containing long acting beta agonists must use EXACTLY as prescribed.
<u>DO NOT</u> try to increase the dose or frequency of these medications.

IMMUNOMODULATORS

Immunomodulators are indicated for long term control and prevention of symptoms in children 12 years old and older who have moderate or severe persistent allergic asthma inadequately controlled with inhaled corticosteroids. Omalizumab binds to circulating IgE, preventing it from binding to the high affinity receptors on basophils and mast cells. Omalizumab decreases mast cell mediator release from allergen exposure.

Generic Name	Brand Name	Dosage Forms	Dosing & Administration	Potential side effects and nursing considerations
Omalizumab (Anti- IgE)	Xolair®	150 mg	Dosing and frequency of administration are dependent upon the serum total IgE level and body weight. Measure total IgE level prior to beginning treatment. SubQ: 0.016 mg/kg/ international unit of IgE every 2-4 weeks.	Monitor patients following injection. Be prepared and equipped to identify and treat anaphylaxis that may occur. A maximum of 150 mg can be administered in one injection.

ORAL CORTICOSTEROIDS

Oral corticosteroids are important during severe asthma exacerbations when inhaled medications are no longer relieving serious breathing problems. Most asthma attacks requiring oral steroids can be managed at home if treatment is started early enough. When asthma awakens a child at night and does not respond to quick relievers the need for oral steroids are likely. In the presence of airway symptoms, a peak flow rate of 50-60% of personal best that does not improve 30 minutes after quick relief medicine points to the need for an oral steroid burst. Most asthma exacerbations respond dramatically by the 3rd day of steroids and by the 5th day are resolved. The need for oral steroids longer than 7 days raises the strong possibility other factors are contributing to the exacerbation. A physical examination and thorough history should be completed by the health care provider.

Generic Name	Brand Name	Dosage Forms	Dosing & Administration
Methyl-prednisolone	Medrol	Tablet: 2, 4, 6, 8, 16, 32 mg	0.25 – 2 mg/kg daily in single dose in the morning or every other day as needed for control (max 60 mg/day) Short course (3-10 days) 1 – 2 mg/kg/day in divided doses 1-2 times/day (max 60 mg/day)
Prednisolone	Several generic forms. Orapred ODT® Pediapred	15 mg/5 ml solution 5 mg tablet Orapred Orally disintegrating tablet: 10, 15, 30 mg Pediapred: 5 mg/5 ml	1-2 mg/kg/day in divided doses 1-2 times/day
Prednisone	Several generic forms Prednisone Intensol	Tablet: 1, 2.5, 5, 10, 20, 50 mg Solution: 1 mg per ml Solution: 5 mg per ml	0.25 – 2 mg/kg daily in single dose in the morning or every other day as needed for control (max 60 mg/day) Short course (3-10 days) 1-2 mg/kg/day in divided doses 1-2 times/day (max 60 mg/day)
Cortisone Acetate	Generic	Tablet: 25 mg	2.5 – 10 mg/kg/day in divided doses every 8 hours
Dexamethasone	Generic Dexamethasone Intensol	Solution: 0.5 mg/ml Tablet: 0.5, 0.75, 1, 1.5, 2, 4, 6 mg Intensol: concentrate 1 mg/ml	0.5 – 2 mg/kg daily in divided doses every 6 hours
Hydrocortisone	Generic Cortef	Tablet: 5, 10, 20 mg	2.5 – 10 mg/kg/day divided every 6-8 hours

DID YOU KNOW?? *Taking oral steroids for 5 days is equivalent to YEARS of daily inhaled corticosteroid [ICS] medications.*

Side effects for all oral steroids include adrenal suppression, headache, increased appetite, weight gain, immunosuppression, and impaired wound healing. Other potential serious side effects include adrenal suppression, osteoporosis, and growth delay. Children's growth should be monitored. These drugs should not be stopped without consulting a health care provider.

THEOPHYLLINE

In Asthma:

- An alternative treatment for mild persistent asthma, or in addition to ICS for moderate persistent asthma
- As adjunct to beta 2 agonist and anti-inflammatory therapy in persistent asthma
- It is not recommended for emergency department treatment of acute exacerbation
- IV administration along with other therapy is sometimes implemented for hospitalized patients
- Serum levels are monitored (maintain level between 5-10 ug/ml)

Pharmacology:

- Maximal therapeutic range is steady state serum concentration of 10-20 ug/ml
- A more conservative range of 5-10 ug/ml is generally recommended.
- Periodic serum monitoring is required.
- Metabolized by the liver.
- Dosage is calculated on ideal body weight.
- Side effects: GI and central nervous system side effects, as well as tachycardia.

Serum Monitoring When:

- Patient first begins theophylline therapy, and at regular intervals of 6-12 months. Patient experiences adverse effects.
- Patient fails to respond optimally when a dose is increased.
- Conditions exist that are known to alter theophylline metabolism.

Drugs & Conditions Altering Theophylline Metabolism:

MANY drug interactions:

Decreased Metabolism (elevated level)

- Liver disease
- Congestive heart failure
- Cimetidine
- Quinoline
- Febrile Illness
- Some antibiotics
- Older Age

Increased Metabolism (decreased level):

- Cigarette smoking
- Young age
- Phenytoin

Exacerbates GERD (gastroesophageal reflux disease is a common contributing factor in moderate and severe asthma)

Toxicity:

- Generally not associated with doses under 15 ug/ml
- Increases progressively with levels above 20 ug/ml
- Nausea and vomiting may be evident
- Symptoms of over-stimulation and/or seizures may occur
- Tachycardia and/or arrhythmias may occur.