

Pamphlet #3: ASTHMA AND BRONCHODILATORS

Wheezing and difficult breathing in asthma are caused by narrowing of the air passageways—called bronchial tubes—of the lungs. One of the important causes of narrowing of the bronchial tubes is contraction of the muscles that are present in a ring or spiral around these tubes. In asthma, contraction of these muscles causes the bronchial tubes to become more narrow than normal.

Medications to Open Bronchial Tubes Wider

Bronchodilators are medications that cause the bronchial muscles to relax and, as a result, the bronchial tubes to open wider or dilate. When these muscles relax, the bronchial tubes can usually open fully again and breathing can become normal. We say “usually” because sometimes the bronchial tubes themselves are swollen and filled with mucus. If this swelling and plugging of the bronchial tubes is present, then a bronchodilating medication will only bring partial relief of asthma symptoms. In this case, even when the bronchial muscles are made to relax, the bronchial tubes remain partially narrowed and blocked. It is important to remember, then, that when used alone, bronchodilators treat the symptoms of asthma but not its underlying property of inflamed bronchial tubes.

In this pamphlet we discuss the various types of bronchodilating medications and their effects in asthma. First, to understand better how bronchodilators work, it is necessary to explore a little more about the bronchial muscles.

Bronchial Muscles Are “Involuntary” Muscles

Muscles in our body over which we have conscious control are called “voluntary” muscles. If we want to, we can make our arms and legs move by causing contraction of the voluntary muscles in our arms and legs. On the other hand, many muscles in our body are controlled unconsciously. For instance, we have no conscious control over the beating of our heart muscle or the contractions of our stomach muscles. Like these muscles, the muscles around our bronchial tubes are “involuntary” muscles; they are under the control of our nervous system but are not controlled by the thinking parts of our brain.

Contraction of the Bronchial Muscles

Although the bronchial muscles do not work quite as fast as the voluntary muscles, they can squeeze or contract over approximately a minute or two. Anyone with asthma who has

experienced the rapid onset of chest tightness and labored breathing and wheezing—for instance, after running on a cold day or being exposed to smoke or strong fumes—knows the effect of bronchial muscle contraction and the rapidity with which it can develop. The good news here is that relaxation of these bronchial muscles can occur equally rapidly, over a period of just a few minutes, allowing the bronchial tubes to widen again and breathing to occur freely.

Bronchodilators and Exercise

If asthma symptoms develop after running on a cold day, the bronchial muscles, left without further stimulation, will usually gradually relax on their own over approximately an hour or less and the symptoms of asthma will go away. Bronchodilators are useful medications because they speed this process of relaxation of the bronchial muscles and can sometimes be used to prevent or block the contraction of the bronchial muscles in the first place. You may have made these observations yourself. If you use your bronchodilator medication before exercising, you may be able to avoid developing wheezing, cough, and shortness of breath. If you use your bronchodilator after exercising has caused symptoms, the medication generally relieves the symptoms within 5 minutes or less. And if you simply stop exercising and wait, you gradually get better again over the next 30-60 minutes or so.

Choices Among Bronchodilators

Bronchodilators can be taken in different forms. They can be breathed in as a spray or mist, swallowed as a tablet, capsule, or liquid, and sometimes given as an injection or intravenous medication (through a needle in a blood vessel). The advantage of inhaling bronchodilators is that the medication goes rapidly and directly to the bronchial muscles; it does not have to pass through the stomach and blood vessels to get there. As a result, inhaled bronchodilators are usually stronger and have fewer unpleasant side effects than swallowed bronchodilators.

Beta-Agonist Bronchodilators

Like most medicines, bronchodilators can be grouped into general “families” or groups of medicines based on their chemical properties. The most widely used family of bronchodilators at the present time is called the beta-adrenergic agonists or beta agonists for short. Beta, the Greek letter “B,” simply distinguishes this family of medications from a different group labeled with the Greek letter for “A,” alpha. Agonists describe medications that stimulate something, and in this case refer to stimulation of the bronchial muscles to relax. Adrenergic refers to the adrenaline-like properties of these medicines.

Some of the inhaled beta-agonist bronchodilators work to relax the bronchial smooth muscles for about 3-4 hours before wearing off and are called short-acting beta-agonist (SABA, for short) bronchodilators. Examples of SABAs likely familiar to you include the generic drugs albuterol and levalbuterol with brand names like *ProAir*[®], *Proventil*[®], *Ventolin*[®], and *Xopenex*[®].

They are available in pressurized canisters (“metered-dose inhalers,” sometimes referred to as “puffers”); in inhalers activated by the force of your breath in (“dry-powder inhalers”); and in the form of a liquid that can be made, with the use of a machine called a nebulizer, into a mist suitable for inhaling.

Other inhaled beta-agonist bronchodilators have a duration of action of approximately 12 hours and are called long-acting beta agonists (LABAs). One beta-agonist has a bronchodilator effect for a full 24 hours and might be considered an ultra-LABA. The LABAs are called formoterol and salmeterol (*Serevent*[®]), and the ultra-LABA is vilanterol. In asthma these long-acting bronchodilators are meant to be taken only in combination with an inhaled steroid, never alone. Multiple inhalers, both metered-dose and dry-powder, that combine a LABA or the ultra-LABA with an inhaled steroid are available. Brand names include *Advair*[®], *AirDuo*[®], *Breo*[®], *Dulera*[®], *Symbicort*[®], and *Wixela*[®]. Using a nebulizer one could take both the liquid formulation of a LABA, formoterol (*Perforomist*[®]) or its derivative arformoterol (*Brovana*[®]), and the liquid formulation of an inhaled corticosteroid, budesonide (*Pulmicort*[®]).

An important feature of the beta-agonist bronchodilators is how quickly they begin to act. All the SABAs begin to relax the bronchial muscles and act to relieve difficult breathing within as few as 3-5 minutes. The same is true for one of the LABAs: formoterol. As a result, these medicines can be considered “quick-relievers” and are sometimes referred to as “rescue” medication. Other people use the expression “emergency inhaler,” but you need not delay their use until you are in an emergency situation!

Some of the beta-agonist bronchodilators are also available in tablet form. Although it often is more convenient to swallow a tablet than to use an inhaler, these same medications when taken by mouth generally are not as strong and tend to have more unpleasant side effects than when breathed in. The most common side effects of beta agonists are raciness, jitteriness, heart pounding, tremulousness, and a nervous feeling. Beta agonists do not cause high blood pressure.

Anticholinergic Bronchodilators

Another family of bronchodilators works to relax bronchial smooth muscles by blocking the nervous system pathways (called cholinergic pathways) that act to cause the bronchial muscles to contract. For many years their use had been restricted to persons with chronic obstructive pulmonary disease (COPD), otherwise known as emphysema and/or chronic bronchitis. Like the LABAs and ultra-LABA, they have been created to work for 12-24 hours. They too have been given a nickname: long-acting muscarinic antagonists or LAMAs. Occasionally they can be substituted for LABAs in persons with an intolerance to beta agonists. More often they are used in addition to LABAs (together with an inhaled steroid) in persons with difficult-to-control asthma. An example of a combination inhaler containing an ultra-LABA, an inhaled steroid, and a once-a-day LAMA is the dry-powder inhaler that combines vilanterol, fluticasone furoate, and umecclidinium, brand name *Trelegy*[®]. Side effects from the LAMAs are few, the most common

being dry mouth. Older men may experience worsened urinary retention, and persons with glaucoma should monitor their eye pressure when starting a LAMA.

Theophylline Family of Bronchodilators

One other family of bronchodilator medications is only available to swallow or inject intravenously: the theophylline family. Historically, the special advantage of this group of bronchodilators was that with some tablets or capsules, the bronchodilator would stay in the blood for 12-24 hours after taking the medicine, making possible use once or twice a day with continuous benefit throughout the day, including overnight. However, the long-acting *inhaled* bronchodilators, with this same long duration of action, have for the most part replaced theophylline for the treatment of asthma. There are several major disadvantages to theophylline bronchodilators. They are not as strong as the beta agonists; they often have unpleasant side effects, especially stomach discomfort, loose bowels, sleeplessness, and jitteriness; and occasionally they can have dangerous effects (abnormal heart rhythms and seizures) when excessive amounts of theophylline get into the blood (an overdose). As a result, theophylline is rarely prescribed nowadays for the treatment of asthma.

What Bronchodilators Do *Not* Do

It is important to remember that not all of asthma is corrected by causing the bronchial muscles to relax. Swelling of the bronchial tubes and their blockage with mucus — the aspects of asthma that we refer to as “inflammation” -- do not go away when bronchial muscles relax. If you use your bronchodilator medication and don't obtain relief of your asthma symptoms, the problem may not be with the bronchodilator. Bronchodilators cannot fix inflamed bronchial tubes. Other medications are available to treat this other aspect of asthma, the anti-inflammatory medications. Remember: if you are having difficulty with your asthma that is not fixed with use of your bronchodilator, other types of treatments are available and are likely to be needed. Your medical provider can prescribe them for you and help guide you in how to use them.