

# PharmaNotes

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## What Is a Beta Blocker?

With contribution by Erin Schwartz, Pharmacy Student at the St. Louis College of Pharmacy at the time of writing

The term “beta blocker” refers to a type of medication commonly prescribed to treat high blood pressure and other heart conditions. “Beta blocker” refers to the name of the drug class. In 1964, Inderal was the first beta blocker studied. Today, over a dozen beta blockers belong to this drug class (Table 1). There are important differences among the beta blockers. These differences affect the decision of which beta blocker to prescribe for a certain patient. This article will compare and contrast some basic qualities of the “beta blocker” drug class.

### Why Do We Use Beta Blockers?

Beta blockers have become mainstay therapy for treating a variety of medical conditions, such as high blood pressure, heart failure, heart attack, angina (chest pain), arrhythmia (irregular heart rhythm), tremor, anxiety disorders, and

(Continued on page 2)

**Table 1: Partial List of Beta Blockers Available in the US**

Acebutolol (Sectral <sup>®</sup> )
Atenolol (Tenormin <sup>®</sup> )
Betaxolol (Kerlone <sup>®</sup> )
Bisoprolol (Zebeta <sup>®</sup> )
Carvedilol (Coreg <sup>®</sup> , Coreg CR <sup>®</sup> )
Labetolol (Trandate <sup>®</sup> )
Metoprolol tartrate (Lopressor <sup>®</sup> )
Metoprolol succinate (Toprol XL <sup>®</sup> )
Nadolol (Corgard <sup>®</sup> )
Nebivolol (Bystolic <sup>®</sup> )
Propranolol (Inderal <sup>®</sup> Inderal LA)
Timolol (Blocadren <sup>®</sup> )

The Centers for Disease Control and Prevention (CDC) issued an official

policy in May 2008, recommending that all people 60 years and older should receive the shingles vaccine. This vaccine, called **Zostavax**, requires just one dose and protects against the herpes zoster virus. Shingles often is marked by debilitating chronic pain that can last from weeks to years. Even older adults who have had shingles in the past should get one dose of Zostavax, according to the recommendation.

The vaccine was found to reduce the occurrence of shingles by 64% in people ages 60 to 69. Overall reduction in people over age 60 is about 50%. The most common side effects of the vaccine are redness, swelling, pain and



tenderness, swelling at injection site; itching and headache.

Shingles results from reactivation of the virus that caused chickenpox earlier in life (varicella zoster). Over 95% of the population has been exposed to varicella zoster at some point, and thus has the potential to develop shingles. Varicella zoster becomes dormant within nerve cells and can be reactivated during adulthood causing shingles during times of severe stress. The shingles rash is marked by clusters of blisters on one side of the body in a band-like pattern.

## Shingles Vaccine in the News

(Continued from page 1)

for preventing migraines (see table 2). All of the beta blockers except for carvedilol and nebivolol are available as less expensive generics. Beta blockers that are eye drops for treating glaucoma or an injection used in the hospital setting will not be discussed here.

How do beta blockers work?

Beta blockers work by blocking or inhibiting the ‘beta’ receptors located in the heart and kidneys, called beta<sub>1</sub> receptors. By attaching to beta<sub>1</sub> receptors in the heart, these

medicines prevent the binding of catecholamines – messenger molecules – called adrenaline (epinephrine) and noradrenaline (norepinephrine) to beta receptors. Normally, these messenger molecules activate the beta receptors, which cause the heart to beat faster and harder and blood vessels to constrict. By blocking these effects, beta blockers slow the heart rate, decrease the force of each contraction, and lower blood pressure. In the kidney, beta blockers decrease the release of a messenger hormone called renin. Renin leads to increased blood

(Continued on page 3)

**Table 2: Comparison of the Beta Blockers**

Beta blocker	Approved Uses	Selectivity for beta <sub>1</sub> or beta <sub>2</sub> receptors	Ability to cross into brain	Route of elimination	Number of doses each day
<b>Acebutolol</b>	blood pressure, arrhythmia	beta <sub>1</sub>	moderate	liver, kidney	2
<b>Atenolol</b>	blood pressure, heart attack, angina	beta <sub>1</sub>	low	kidney	1 or 2
<b>Betaxolol</b>	blood pressure	beta <sub>1</sub>	low	kidney, liver	1
<b>Bisoprolol</b>	blood pressure	beta <sub>1</sub>	low	kidney, liver	1
<b>Carvedilol</b>	blood pressure, heart failure	beta <sub>1</sub> , beta <sub>2</sub>	high	liver	2 (Coreg) 1 (Coreg CR)
<b>Labetolol</b>	blood pressure	beta <sub>1</sub> , beta <sub>2</sub>	moderate	liver, kidney	2
<b>Metoprolol tartrate (short-acting) &amp; succinate (long-acting)</b>	blood pressure, heart attack, angina. Heart failure — long-acting only (Toprol XL)	beta <sub>1</sub>	moderate	liver, kidney	1 or 2 (Lopressor) 1 (Toprol XL)
<b>Nadolol</b>	blood pressure, angina	beta <sub>1</sub> , beta <sub>2</sub>	low	kidney	1
<b>Nebivolol</b>	blood pressure	beta <sub>1</sub>	high	liver, kidney	1
<b>Propranolol</b>	blood pressure, angina, heart attack, arrhythmia, migraine, tremor	beta <sub>1</sub> , beta <sub>2</sub>	high	liver	3 or 4 (Inderal) 1 (Inderal LA)
<b>Timolol</b>	blood pressure, migraine	beta <sub>1</sub> , beta <sub>2</sub>	low to moderate	liver, kidney	2

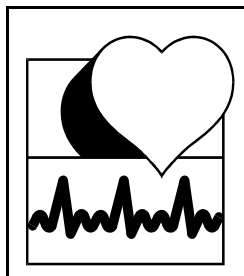
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pressure. Thus, decreasing renin levels contributes to lower blood pressure.

Carvedilol and nebivolol are the newest beta blockers. Each works in yet another way to lower blood pressure.

Carvedilol also blocks alpha receptors located in blood vessels. This causes blood vessels to relax. Nebivolol increases the release of a chemical in the body called nitric oxide. Nitric oxide directly relaxes blood vessels and lowers blood pressure.

The full importance of these unique mechanisms is not yet known.



#### How Do Beta Blockers Differ?

Important distinctions among beta blockers are summarized in table 2 and described below. These include selectivity, ability to cross into the brain, how it is eliminated from the body, and half-life.

#### *Selectivity*

Selectivity of a beta blocker is one of its most important distinctions. There are 2 types of beta receptors to which beta blockers can attach or bind in the body: beta<sub>1</sub> and beta<sub>2</sub>. Beta<sub>1</sub> receptors are located in the heart and kidneys, as described above.

Beta<sub>2</sub> receptors are located most notably in

the lungs. Beta blockers are called “selective” if they bind preferentially to beta<sub>1</sub> receptors, while they are called “nonselective” if they bind both to beta<sub>1</sub> and beta<sub>2</sub> receptors. At high enough doses though, even selective beta blockers will block both types of receptors. Selectivity becomes important especially for patients with asthma and other breathing conditions.

#### *Crossing into the Brain*

Medicines cross into the brain more easily if they dissolve into fat or lipid tissue in the body. For a beta blocker, this quality affects its side effect profile and also its ability to treat certain medical conditions. Side effects more common in beta blockers that cross in to the brain include drowsiness, dizziness, sleep disturbances, nightmares, and depression. Because propranolol easily dissolves into lipid tissue and enters the brain, it is effective for treating migraines, for example.

#### *Route of Elimination*

Beta blockers differ in how they are eliminated from the body. Most beta blockers are eliminated through the liver. A few leave the body through the kidneys and urine. Some rely on both routes. For patients who have impaired liver or kidney

(Continued on page 4)

## About HbL PharmaConsulting

**H**bl PharmaConsulting offers professional consultations to patients who take multiple medications. The goals of each consult include preventing and correcting medication-related problems, improving patient quality of life, and identifying ways to reduce drug costs. For more information, contact Dr. Levy.

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*(Continued from page 3)*

function, it is important to choose a beta blocker that will be safely eliminated from the body.

**Half-life**

A drug’s half-life refers to how long the drug remains in the body to exert an effect. Beta blockers that remain in the body for a short time must be taken 3 or 4 times a day, whereas beta blockers with long half-lives are taken just once or twice a day. Sometimes a long-acting formulation is made for a medicine that has a short half-life, making it much more convenient to take, as with propranolol (Inderal LA). Choosing a beta blocker that can be given once or twice a day usually is preferred, because it is easier for patients to take.

**What Are the Side Effects of Beta Blockers?**

The most common side effects of the beta

blocker drug class are fatigue, drowsiness, dizziness, and weakness. Less common side effects include sleep disturbances, decreased sex drive, and slow heart rate. All beta blockers can hide the signs of low blood sugar in patients with diabetes, such as tremor, increased heart rate, and palpitations. Patients with diabetes need to be aware that sweating might be their only symptom of low blood sugar.

**What Interactions Can Occur with Beta Blockers?**

Interactions with drugs and medical conditions that are common to the drug class are found in Table 3. Carvedilol, metoprolol, nebivolol, and propranolol are most likely to interact with other drugs because they are eliminated from the body through the liver. Calcium supplements or antacids can decrease atenolol absorption from the stomach;

*(Continued on page 5)*

**Table 3: Common Interactions with Beta Blockers**

Drug or medical condition	Management approach
<b>Asthma, chronic obstructive pulmonary disease (COPD)</b>	Nonselective beta blockers should be avoided in patients with asthma. Selective beta blockers can be used carefully in patients with COPD. Watch for worsened breathing condition.
<b>Clonidine</b>	Do not stop either clonidine or a beta blocker suddenly; can cause severe high blood pressure. Need to taper dose.
<b>Diabetes</b>	Beta blockers can mask symptoms of low blood sugar; can worsen blood sugar control.
<b>Digoxin Diltiazem Verapamil</b>	Watch for heart rate that is too slow.
<b>Nonsteroidal anti-inflammatory drugs (NSAIDs) like etodolac, ibuprofen, meloxicam, naproxen, others</b>	Watch for increase in blood pressure; adjust dose of blood pressure medicine as needed. Use lowest dose of NSAID and for shortest time possible.
<b>Pseudoephedrine, phenylephrine (decongestants found in nonprescription cough and cold products)</b>	Watch for increase in blood pressure. Use decongestant only if blood pressure is controlled. Use for shortest time possible.

*(Continued from page 4)*

these drugs should be taken at least 2 hours apart. In addition to diabetes and asthma listed in table 3, beta blockers can worsen symptoms of depression, peripheral arterial disease, and heart block and should be used carefully in these situations. It is important always to check with a pharmacist about interactions that might occur with a specific beta blocker.

#### Choosing a Beta Blocker

Which beta blocker is right for a particular patient depends on many factors:

- Medical condition being treated (for example blood pressure vs. heart failure)
- Interactions with other medicines
- Interactions with medical conditions
- Side effect concerns
- Kidney or liver function

- How many doses per day
- Cost (generic availability)

#### Other Tips for Safe Use of Beta Blockers

Beta blockers should be taken at the same time of day every day. Do not stop taking a beta blocker suddenly, as this could lead to a worsening of blood pressure or severe angina and increase the risk of a heart attack. Most patients need to take a beta blocker lifelong and thus should share any concerns they have about their therapy with their physician. It also is important to continue regular visits with a physician to monitor for continued safety and effectiveness of beta-blocker therapy.

*Contact HbL PharmaConsulting for more information.*



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