Carotid Angioplasty and Stenting
Your Carotid Artery Problem

The carotid arteries are blood vessels in the neck that carry blood to the brain. One or both of your carotids is narrowed due to a buildup of plaque, a fatty material that sticks to artery walls. Narrowing can reduce the brain’s blood supply and increase the risk of a stroke (loss of brain function due to death of brain tissue). A device called a stent can be put in place to hold the artery open and reduce stroke risk.

Are You At Risk of a Stroke?

Plaque in the carotid arteries increases your risk of stroke. Other risk factors include high blood pressure, high cholesterol levels, smoking, diabetes, and having heart disease or other types of vascular (blood vessel) disease. A stroke is a serious problem. It can cause severe disability, including difficulty with speaking, walking, and doing the simplest tasks. And a stroke can be deadly. This is why your doctor is suggesting treatment to lower your risk.

Symptoms of a Stroke

Below are symptoms of a stroke. The longer you delay getting treatment, the more damage a stroke can do. Call 911 right away if you have any of these symptoms:

- Paralysis or weakness on one side of the body
- Numbness or tingling on one side of the body
- Difficulty speaking
- Loss of vision in one eye
- Drooping on one side of the face

Sudden weakness on one side of the body can be a sign of stroke.
How Carotid Artery Stenting Can Help

If your doctor suspects narrowing of the carotid artery, you’ll have tests to assess your need for treatment. Surgery to remove plaque (endarterectomy) is often used to correct the problem. Stenting is a new alternative to endarterectomy that is a better option for some people. A stent is a metal mesh tube that’s inserted into the artery, helping to hold the artery open. This improves blood flow. Stenting uses a small puncture instead of an incision, so it’s called a “minimally invasive” or endovascular procedure.
**How a Stroke Can Occur**

Blood carries oxygen and nutrients to wherever they’re needed in the body. The brain needs a steady supply of blood to work. Problems with the vessels that supply blood to the brain can block blood flow. If this happens, parts of the brain can become starved of oxygen and nutrients. This damages the affected area of the brain, which can impair certain body functions.

**From the Heart to the Brain**

The heart pumps blood throughout the body. Blood vessels called **arteries** carry blood to the limbs and to the organs, including the brain. The carotid arteries are two of the main pathways for blood traveling to the brain. There are two **common carotid arteries**, each traveling up one side of the neck. Each artery divides into two branches. The **internal carotid artery** carries blood into the brain, and the **external carotid artery** supplies blood to the face and scalp.

**Healthy Carotid Arteries**

When carotid arteries are healthy, the artery walls are smooth. The arteries are open, allowing blood to flow freely to the brain. The brain gets all the blood it needs to function well.
Narrowed Carotid Arteries
Arteries can become damaged due to risk factors such as smoking, diabetes, and high blood pressure. Heredity (family history) also makes some people more prone to artery damage. A damaged artery no longer has a smooth lining. Cholesterol and other particles in the blood stick to the artery wall and form plaque. A buildup of plaque leads to **stenosis** (narrowing of the artery). This can reduce blood flow.

How Plaque Causes Blockage
The surface of plaque may be rough. Blood can collect there and form clots. Also, plaque can rupture, causing pieces to break off and enter the bloodstream. At the same time, rupture can produce more blood clots. Fragments of plaque and tiny blood clots (**emboli**) then travel to and block smaller arteries in the brain. This cuts off blood flow to a portion of the brain, resulting in a stroke.

How a Stroke Affects You
When blood flow is cut off, brain tissue can die, causing loss of brain function. This results in problems such as difficulty speaking or controlling movements. The exact symptoms depend on which part of the brain is affected. Symptoms often occur on one side of the body only, the side opposite the blockage. A stroke does permanent damage that can cause long-lasting loss of function.

What Is a TIA?
A TIA (transient ischemic attack) is a temporary episode of stroke-like symptoms. It is sometimes called a “mini-stroke.” Having a TIA is a warning that you’re at high risk of a stroke. TIA symptoms go away within 24 hours, but otherwise they are exactly the same as stroke symptoms. If you have stroke symptoms, don’t waste time wondering whether you’re having a TIA: **Call 911 right away!**
Your Medical Evaluation

Is your carotid artery problem severe enough to need treatment? And is stenting the right treatment for you? An evaluation can give your doctor the information needed to make these decisions. This evaluation includes a medical history, an exam, and one or more imaging tests.

Medical History

Your doctor will ask whether you've had symptoms of a TIA or stroke. These include numbness, weakness, and vision changes. You'll also be asked about factors that affect your vascular health, such as smoking and high blood pressure. You'll describe any current health problems, such as heart disease, kidney disease, and lung disease. And you'll be asked about previous treatments and surgeries for artery problems.

Physical Exam

During your physical exam, your doctor will check your blood pressure and your pulse. He or she will also listen for the sound blood may make when it travels through a narrowed carotid artery. This sound is called a bruit (pronounced “broo-ee”). It is possible to have stenosis without having a bruit. The blood vessels in your eyes may also be checked for small emboli that can indicate carotid artery problems. Your doctor may then look for the effects of a past stroke. This includes checking reflexes, strength, vision or other senses, and the ability to understand and use language.

Your doctor will use a stethoscope to listen for signs of narrowing in your carotid arteries.
Angiography
This test provides information needed to make decisions about treatment and to plan the procedure. Angiography may be done around the same time as other imaging tests. Or it may be done just before the stent is placed. For angiography:

- A catheter is inserted into an artery in the groin.
- Contrast fluid is injected through the catheter into the artery.
- X-ray images (angiograms) of the carotid are taken. Angiograms of arteries in the groin and torso may also be taken.

Duplex Ultrasonography
Duplex ultrasonography (ultrasound) is a noninvasive test. A scanner uses harmless sound waves to create images. A gel applied to the neck helps the scanner collect sound waves. The test checks for narrowing in the carotid arteries and estimates how severe it is. Duplex ultrasound also shows how blood flow through the arteries is affected. The results can indicate whether an artery needs treatment.

Other Imaging Tests
These tests may be used to check the brain for signs of a stroke. They may also be used to take pictures of the arteries.

- **CT (computed tomography)**: A series of x-rays is taken with a special x-ray machine. Computers use these x-rays to create three-dimensional images. For CT angiography (CTA), contrast fluid (“x-ray dye”) may be injected to help arteries show up clearly on the x-ray.

- **MRI (magnetic resonance imaging)**: This test uses a strong magnet to create detailed images of the body. A contrast fluid may be injected to highlight the arteries. It is different from the contrast fluid used for CTA.
Preparing for Carotid Artery Stenting

You will be told how best to prepare for your procedure. This often includes stopping certain medications and starting others. Be sure to follow your doctor’s instructions. If you’ve had an angiogram before, many of these preparations will be familiar.

A Week or More Beforehand

Before stenting is done, you may talk to and be examined by one or more specialists. Before the procedure, be sure to:

■ Tell your doctor if you have any allergies to foods or medications.
■ Tell your doctor about any medications you take. This includes over-the-counter medications, herbs, and supplements.
■ Make medication changes as directed by your doctor. You will take one or more medications to help prevent blood clots from forming in arteries. These antiplatelet medications may include aspirin and prescription medication.

The Day Before the Procedure

Before you have your stenting procedure, be sure that you:

■ Pack for an overnight stay in the hospital.
■ Arrange for a ride to and from the hospital.
■ Don’t eat or drink after midnight, the night before the procedure. (Ask your doctor which medications to take during this period. Take them with a sip of water.)
■ Follow any other instructions from your doctor.
During the procedure you’ll be covered with sterile drapes to protect you from infection.

On the Day of the Procedure
When you arrive at the hospital, the staff will prepare you for the procedure. First you’ll change into a hospital gown. An area around your groin may then be prepared. An IV (intravenous) line will be started to provide you with fluids and medications. You will then be taken to the cath (catheterization) lab or angiography suite. This is a room that has all the equipment needed to perform the procedure.

Risks and Complications
Risks of carotid artery stenting include:
- Stroke
- Bleeding at puncture site
- Hypotension (low blood pressure)
- Thrombosis (blood clot) in the treated vessel
- Reaction to contrast fluid
- Cardiac arrhythmias (heart rhythm problems)
- Need for retreatment
- Worsening of kidney function
- Heart attack
- Death
The Procedure

During the procedure, a long thin tube called a catheter is inserted into the artery. This is used to move instruments through the artery to put the stent in place. Working in the area can disturb plaque and cause pieces to break off. So, steps are taken to be sure these emboli don’t flow into the brain. Your doctor will need to talk to you during the procedure, so you’ll be awake the entire time.

Inserting the Catheter

To insert the catheter and prepare for stenting:

- The skin in the area of the insertion site is numbed with local anesthetic. A puncture is made in the femoral artery, a major artery in the groin.
- An introducing sheath (tube) is inserted into the puncture. The sheath remains in place throughout the procedure.
- The catheter is inserted into the sheath. Using x-rays as a guide, the doctor moves the catheter up the aorta, behind the heart, and to the carotid.
- An angiogram of the carotid artery is taken.

Placing the Filter

A filter or other protective device catches fragments of plaque that may break off. This prevents them from flowing into the brain and causing a stroke. The catheter is used to place the unopened filter in the artery and advance it past the narrowed area. The filter is then opened. It remains in place for the whole procedure. If narrowing is very severe, the artery may need to be widened before the filter is put in place.
The Stent: A Closer Look

A carotid artery stent is a flexible wire mesh tube. It may be all one width, or it may be wider at one end. Once it’s placed in the artery, it remains there for life. The stent is resistant to pressures and crushing, so it adjusts easily when you move your head and neck. The stent fits snugly in the artery so it won’t slip out of place.

Opening the Artery

As part of placing the stent, the narrowed artery needs to be expanded. This is done using balloon angioplasty. A tiny, uninflated balloon is first moved to the area that needs to be widened. The balloon is then inflated, opening the artery. Afterward, it is deflated and removed.

Placing the Stent

The stent is moved to the site of the plaque. The catheter is then withdrawn, leaving the stent in place. The stent expands until it touches the plaque. Balloon angioplasty is then used to expand the stent fully and widen the artery. The balloon is withdrawn, leaving the stent in place to hold the artery open.

Checking the Result

An angiogram is taken and compared to the one that was taken at the beginning of the procedure. This is to check on the success of the procedure. Once your doctor is satisfied with the result, the filter and other instruments are withdrawn. The groin insertion site is then closed.
After the Procedure
After carotid artery stenting, you will most likely stay overnight in the hospital for care and monitoring. At home, follow your doctor’s instructions for recovery. Be sure to keep your medical appointments. Seeing your doctor for imaging tests and other follow-up treatment helps make the procedure a success.

Just After the Procedure
The sheath in your groin is removed, and the insertion site closed. This may be done while you’re still in the lab where the procedure took place. Or it may be done after you’ve been moved to a regular hospital room. A nurse may apply pressure to the site for several minutes. Depending on the type of closure, you may need to keep your leg straight for 2 to 6 hours.

Your Hospital Stay
You’ll be closely monitored until you’re ready to go home. Hospital staff will check your pulse and blood pressure from time to time. You may also have certain tests, such as tests of your brain function, blood tests, or an ultrasound. Your IV will remain in place until shortly before you go home.

Going Home
You can leave the hospital when:

- Your condition is stable.
- The groin insertion site is not bleeding.
- You have no signs of infection.
- Your doctor has reviewed any test results and has cleared you to go home.

You’ll likely go home the day after the procedure. An adult family member or friend should take you home.
Recovering at Home

When you get home:

■ Take prescribed antiplatelet medications as directed. This is needed to prevent blood clots from forming on the stent. It is normal for these medications to cause you to bruise more easily.

■ Shower instead of taking tub baths for a few days.

■ Avoid lifting anything over 10 pounds for a few days.

■ Take it easy, but get back to your normal routine as much as possible.

■ Follow your doctor's instructions about driving, returning to work, and other activities.

Your Follow-Up

Within a month after the procedure, you'll have a follow-up exam and tests. These tests may include an ultrasound and a brain function exam. Then you'll be monitored with ultrasound or another imaging test every 6 months for 1 to 2 years. After that, you'll be monitored at least every 12 months. You may also continue to take antiplatelet medication. In rare cases, the carotid can narrow again. If this happens, it can often be treated again with balloon angioplasty.
Taking Control of Your Health

There’s a lot you can do to improve your health. To help make your stenting procedure a success, take medication as prescribed. If you smoke, quit—this can reduce your future risk of stroke or heart attack. And manage conditions such as high blood pressure, diabetes, and cholesterol problems by exercising and eating healthier. The tips on these pages can help you get started.

Taking Medication

After the stenting procedure, you’ll need to take antiplatelet medication. You may also need to take medication to control cholesterol, diabetes, and other artery disease risk factors. To get the most benefit from medications:

■ Make sure you know when and how to take your medications, and what to do if you miss a dose.

■ Develop a routine so you don’t miss doses. A pillbox with days of the week or hours of the day can help you keep track.

■ Tell your doctor if you have any side effects.

■ Don’t stop taking your medication or make any other changes without first talking to your doctor.

Quitting Smoking

Smoking damages blood vessels. It also makes blood clots more likely to form. If you smoke, quitting is one of the best things you can do to protect your health. To get started:

■ Get medical help. Your healthcare provider may prescribe medications or other aids to help you quit.

■ Get support. Ask your healthcare provider about local stop-smoking programs or support groups. Explain to your family and friends why you’re quitting, and ask for their help.

■ Avoid temptations to smoke. Stay away from places and activities that make you want to light up.

■ Don’t give up. Sometimes it takes more than one try to quit for good.
Healthy Eating
For healthier eating:
- **Build more meals around plant-based foods.** Good choices include vegetables, fruits, whole grains, and beans.
- **Switch to lower-fat dairy products.** For example, if you normally use whole milk, try reduced fat or fat free instead.
- **Avoid fatty meats.** Choose fish, poultry, and leaner cuts of meat instead.
- **Choose fresh or plain frozen foods.** Mixes and packaged foods are often high in sodium and unhealthy fats.

Being Active
Daily activity can be fun and can help you feel better. To get started:
- **Talk to your doctor before starting an exercise program.**
- **Increase your activity level gradually.** Work up to 30 minutes of walking or other exercise most days of the week.
- **Be more active in small ways each day.** For example, walk to see a friend instead of driving. Or do some of your errands on foot.

Tips for Making Lifestyle Changes
Making changes can seem overwhelming. So take things one step at a time:
- Work with your doctor to set goals for improving your health.
- Write down two or three things you can do to meet each goal.
- When you meet a goal, reward yourself. Then think about a new goal.
- Be positive. You don’t have to be perfect. If you slip up, try again. Don’t let a slip become an excuse for giving up.
Taking Care of Your Vascular Health

A carotid artery stent can reduce your risk of having a stroke. But it doesn't treat the artery disease that caused the problem in the first place. So you should take steps to improve your vascular health. The following resources can help you learn more.