

# Carotid Occlusive Disease

## What is a Stroke?

A stroke is a "brain attack" and a medical emergency. At the first sign of a stroke, call 911. Non-surgical procedures can open blocked arteries to prevent and treat strokes.

A stroke occurs when a blood vessel carrying oxygen and nutrients to the brain is blocked by a clot or bursts, causing the brain to starve. If deprived of oxygen for even a short period of time, the brain nerve cells will start to die. Once the brain cells die from a lack of oxygen, the part of the body that section of the brain controls is affected through paralysis, language, motor skills, or vision.

## Stroke Prevalence

- Stroke is third leading cause of death in United States, behind high blood pressure and cancer
- Every 45 seconds someone in the United States has a stroke
- Every three minutes someone dies from a stroke

## Types Of Stroke

### Ischemic Stroke

Strokes caused by blood clots that block the artery are ischemic (is-KEM-ik) strokes. This is the most common type, accounting for 70-80 percent of all strokes.

### Hemorrhagic Stroke

When a blood vessel ruptures, it causes a bleeding or hemorrhagic (hem-o-RAJ-ik) stroke. Once the brain cells die from a lack of oxygen, the part of the body controlled by that section of the brain is

affected. Strokes can cause paralysis or language, motor skills or vision difficulties.

## **"Mini-Stroke"**

There are also "mini-strokes" known as TIAs (transient ischemic attacks). People who have one TIA are likely to have another one. TIAs cause brief stroke symptoms that go away after a few minutes or hours. People often ignore these symptoms, but they are an early warning sign and 35 percent of those who experience a TIA will have a full blown stroke if left untreated. TIAs should be taken as seriously as stroke.

## **Symptoms of Stroke**

The most common symptoms of stroke are:

- Sudden numbness or weakness in the face, arm and/or leg, especially on one side of the body.
- Sudden confusion, trouble speaking or understanding speech.
- Sudden trouble seeing, including double vision, blurred vision or partial blindness, in one or both eyes.
- Trouble walking, dizziness, loss of balance or coordination.
- Sudden severe, headache with no known cause.

If you experience any of these symptoms, even if they go away quickly, seek immediate emergency help.

Every minute counts. Although starved of oxygen, brain tissue does not die in the minutes following a stroke. If blocked blood vessels can be opened within three to six hours, the chances of recovery are greatly improved.

## **Risk Factors of Stroke**

- Obesity, high blood pressure and high cholesterol all increase the risk of stroke. These

risk factors can be greatly reduced with healthy lifestyles or medication.

- High blood pressure puts pressure on the arteries, making them more susceptible to rupture and more prone to clot formation, which can block the artery.
- High cholesterol can lead to blockage in the carotid artery that takes blood from the neck to the brain. A piece of this plaque can break off and travel to the brain, causing a stroke.
- Obesity can cause high blood pressure and high cholesterol.
- Untreated atrial fibrillation causes the heart's upper chamber to beat irregularly, which allows the blood pool and clot. If a clot breaks off and enters the blood stream to the brain, a stroke will occur.
- Sickle cell anemia makes red blood cells less able to carry blood to the body's tissues and organs, as well as stick to the walls of the blood vessels. These cells can block arteries to the brain, causing a stroke.
- Family history
- Smoking

## **Prevention and Carotid Stenting**

As vascular experts, interventional radiologists treat atherosclerosis, "hardening of the arteries," throughout the body. In some patients, atherosclerosis, specifically in the carotid artery in the neck, can lead to ischemic stroke. Plaque in the carotid artery may result in a stroke by either decreasing blood flow to the brain or by breaking loose and floating into a smaller vessel, depriving a portion of the brain of blood flow. In patients at high risk of having a stroke, the narrowed section of artery may be reopened by an interventional radiologist through angioplasty and reinforced with a stent, thereby preventing the stroke from occurring. Vascular stents are typically made of woven, laser-cut or welded metal that permits the device to be compressed onto a catheter and delivered directly into the hardened artery. In addition to diagnosing and treating those at risk for stroke, interventional radiologists use their expertise in imaging, angioplasty and stenting to treat those having an acute stroke.

The carotid arteries on either side of the neck supply blood to the brain

Patients can also take action to prevent strokes by:

- Stop smoking
- Controlling high blood pressure
- Lowering cholesterol levels
- Maintaining healthy weight
- Exercising
- Utilizing appropriate medications like aspirin, prescription drugs like anticoagulants
- Treating carotid artery disease
- Treating unruptured cerebral aneurysm or arteriovenous malformation

## Assessing Patients at Risk for Carotid Artery Disease and Future Stroke

**Physical examination.** Your doctor may be able to assess your risk for stroke during a routine physical examination. If your physician suspects that you may be at high risk, he or she will ask if you have experienced symptoms such as numbness or muscle weakness, speech or vision difficulties, or lightheadedness. By listening to the carotid artery through a stethoscope, the doctor may hear a rushing sound, called a bruit ("brew-ee") that suggests the artery may be obstructed. Physical exam is not always accurate, however, and further tests may be ordered.

**Ultrasound.** A technique called doppler ultrasound that creates pictures using sound waves can determine whether there is blockage in the arteries that carry blood to the brain. Some physicians recommend ultrasound screening for those who have been diagnosed with atherosclerosis or other risk factors for carotid artery disease. In the ultrasound image shown here, the colors red and blue indicate direction of flow.

**Magnetic Resonance Angiography (MRA).** This is a non-invasive diagnostic technique that creates an image of the arteries in the brain. A magnetic resonance (MR) scanner uses harmless but powerful magnetic fields and radio waves to create detailed images of the body's tissues.

## Diagnostic Exams

There are a number of diagnostic exams that can be performed to determine if someone has had a stroke or is at risk for having one.

A CT scan. The area affected by stroke is purple. **Computed tomography (CT).** The first diagnostic test

performed in the emergency room is usually a CT scan. CT uses computers to generate detailed pictures of the brain, and can confirm the diagnosis of stroke and tell whether the stroke is caused by a hemorrhage in the brain.

Patient having an angiogram

**Magnetic resonance imaging (MRI)** is a diagnostic test which may be performed to identify and further localize the site of the stroke and find the source. It may be able to quickly identify the area deprived of sufficient blood flow and guide further therapy. In the MR Image, the arrow points to the area affected by a stroke.

**Angiography.** An angiogram is an X-ray in which a contrast agent, or dye, is injected into a vein to highlight the blood vessels. With this exam, radiologists can pinpoint the exact location of blockage or bleeding in the brain. Angiography also is used to guide thin tubes called catheters to the site of the problem and administer treatments.

## **Treatment**

Interventional radiologists are a critical part of the stroke team in hospitals and are actively involved in creating more stroke teams across the country. Stroke teams generally consist of emergency room physicians, neurologists, and interventional radiologists.

For those having a stroke, it must first be determined which kind of a stroke the patient is having so the proper treatment can be given. The interventional radiologist interprets the non-contrast CT (computed tomography) imaging to determine if acute stroke patients are candidates for clot-busting drugs. CT is quick, inexpensive, and readily available.

If the stroke is determined to be ischemic (due to a blood clot), the interventional radiologist will assess what caused the clot, such as a clogged carotid or other artery, and can correct the underlying problem to prevent future strokes from occurring.

## Treatment to Dissolve Blood Clots

If the stroke is due to a blood clot, a clot-busting drug, **tPA (tissue plasminogen activator)** can be given intravenously to break up or reduce the size of blood clots to the brain. This technique must be performed within **three hours from the onset of symptoms**.

When therapy cannot be initiated within three hours or when treatment with tPA during the first three hours is not sufficient to dissolve the blood clot, interventional radiologists (IR) that specialize in neurological procedures can provide **intra-arterial thrombolysis** treatment.

Using x-ray guidance, an IR will insert a catheter through a nick in the skin at the groin and advance it through the femoral artery in the leg all the way to the tiny arteries in the brain where they place the clot-busting drug directly on the clot or to break up the clot mechanically.

When given locally this way, the tPA can be administered up to **six hours** after the onset of stroke symptoms. In many cases, the ambulance drivers will take a stroke victim past the three-hour window directly to the interventional radiology suite for assessment for this direct thrombolytic therapy. Often a significantly disabled stroke patient who receives this treatment can return to normal life with minimal or no after effects from the stroke.

The interventional radiologist will also assess what caused the clot, such as a clogged carotid or other artery, and can correct the underlying problem to prevent future strokes from occurring. Unfortunately, many hospitals in this country do not have stroke teams that can rapidly assess patients and provide treatment within the three-hour window. Interventional radiologists are actively involved in creating more stroke teams across the country. Stroke teams generally consist of emergency room physicians, neurologists and interventional radiologists.

Before tPa therapy

After tPa therapy

## Treatment for Hemorrhagic Stroke

Interventional neuroradiologists can also treat ruptured aneurysms inside the brain causing hemorrhage into the subarachnoid space, which can cause stroke or death. During the embolization technique, an interventional neuroradiologist inserts a catheter through a nick in the skin of the groin and advances it to the site of the ruptured blood vessel. An embolizing agent (a substance that clots or closes off the bleeding blood vessel) is injected under X-ray guidance. Most commonly, tiny metal coils are used to embolize and block the abnormal blood vessel or aneurysm. The catheter is withdrawn and the coils remain to provide the occlusion. The same technique can be used to treat aneurysms and AVMs before they rupture. Surgery had been the primary treatment available until the platinum coil device was approved by the FDA in 1995.

## Stroke Facts and Statistics

- Nearly half of all stroke fatalities occur before emergency medical personnel arrive.
- 1.1 million Americans live with disabilities caused by a stroke.
- 600,000 Americans will have a new or recurrent stroke each year?of these, 160,000 will die.
- Stroke is a medical emergency with a narrow time frame for treatment?people should call 911 immediately.
- Strokes can be treated intravenously with the clot-busting drug, tPA (tissue plasminogen activator), if it is given within three hours of the onset of symptoms.
- Persons who have a transient ischemic attack (TIA), also known as a mini-stroke, are likely to have another one. Transient ischemic attacks cause brief stroke symptoms that go away. People often ignore these symptoms, but they are an early warning sign and 35 percent of those who experience a TIA will have a full-blown stroke if left untreated.
- Stroke is not just an older person's disease?28 percent of strokes occur in people under age of 65.
- More men than women have strokes?although more women die from them.

- African Americans are at much higher risk for stroke. In part, this is because African Americans are at increased risk for obesity, high blood pressure and diabetes, which increase the risk of stroke.
- May is Stroke Awareness Month.

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