

Stroke

Brain Attacks

Strokes are the third leading cause of death in the United States, affecting over 500,000 Americans every year. They usually come on suddenly, with little or no warning, and the results can be devastating.

Understanding the factors that increase the risk of a stroke and recognizing the symptoms may help you to seek the kind of early treatment and diagnosis that will improve your chances for complete recovery.

What is a stroke?

A stroke occurs when the normal blood supply to the brain is interrupted. This can happen in several ways. A thrombosis, or blockage in a blood vessel, or an embolism, a fatty deposit or clot which breaks loose and follows the blood stream until it lodges in a smaller vessel, can literally cause the brain to starve to death in a very few minutes by depriving it of blood.

The problem in these cases is too little blood. Too much blood in the wrong place is equally perilous. A hemorrhage, or break, in a blood vessel allows the blood to flood the brain bringing injury - and often irreversible damage - to the delicate structures of the brain.

Who is at risk for a stroke?

Although they are more common in the elderly, strokes can occur at any age.

You face increased risk of a stroke if you:

- * smoke
- * have high blood pressure
- * have diabetes
- * have a history of heart disease
- * have high serum cholesterol
- * use oral contraceptives (birth control pills)

What are the symptoms of a stroke?

The range and severity of early stroke symptoms vary considerably, but they share a common characteristic: suddenness.

Warning signs may include some or all of the following symptoms:

- * unusually severe headache
- * confusion, disorientation or memory loss
- * numbness, weakness or clumsiness of an arm, leg or side of the face
- * abnormal or slurred speech
- * loss of vision

* poor balance or lack of coordination

About 30 percent of stroke patients have a history of transient ischemic attacks, or TIAs. These "small strokes" have basically the same symptoms, but usually subside quickly (often within a few minutes, and nearly always within 24 hours).

How are strokes being treated?

Rehabilitation following a stroke may involve a number of medical specialists; but the early diagnosis of a stroke, its treatment or its prevention, is usually undertaken by internal medicine specialists (internists) and neurologists. Neurosurgeons may have a role in certain forms of stroke but general are not in the first line of diagnosis for strokes.

Rapid and accurate diagnosis of the kind of stroke and the exact location of its damage is critical to successful treatment. Such technical advances as the use of the operating microscope (microsurgery) and the surgical laser have made it possible to treat stroke problems that were thought to be inoperable a few years ago.

When there is a warning, or when the stroke is identified early, there may be several options for surgical treatment. A neurological surgeon may be able to:

- * repair a bleeding aneurysm inside the head
- * remove blood clots within the skull or brain
- * remove plaques that may break loose from the carotid artery in the neck

What do you know about Stroke?

A stroke or "brain attack" occurs when a blood clot blocks a blood vessel, or when a blood vessel breaks, interrupting blood flow to an area of the brain. A stroke kills brain cells and is a life-threatening medical emergency. Many strokes can be prevented if symptoms are recognized and risk factors managed. If a stroke occurs, treatments are available, but are most effective if given quickly. A quick response can greatly effect the outcome of stroke.

Did you know the following?

- * Stroke risk increases with age. For each decade after age 55, the risk of stroke doubles
- * Incidence rate for first stroke among African-Americans is almost double that of white Americans (288 per 100,000 African-Americans versus 179 per 100,000 whites) because they have a disproportionately high incidence of the risk factors for stroke.
- * Women account for approximately 43 percent of strokes that occur each year, but they account for 61 percent of stroke deaths.

Cerebrovascular disease is one of the most devastating, and most misunderstood, epidemics of our time. More than 700,000 Americans suffer a major cerebrovascular event -- usually a stroke -- each year. Stroke is the third leading cause of death in the United States and the number one cause of disability with more than 3,000,000 currently living with permanent brain damage caused by such an event. On average, someone in the United States suffers a stroke every 53 seconds and every 3.3 minutes someone dies of one.

The word "cerebrovascular" is made up of two parts "cerebro" which refers to the large part of the brain and "vascular" which means arteries and veins. Together, "cerebrovascular" refers to blood

flow in your brain. The term cerebrovascular disease covers acute stroke and other diseases that may lead to stroke, like carotid stenosis and aneurysms.

Despite being only about 2 percent of total body weight, your brain continuously receives about 20 percent of the blood that flows through your entire body. Your brain controls every action your body makes from walking and talking to moving your arm and breathing. Your brain requires the constant supply of energy brought by the blood to keep functioning and make these things happen.

Stroke occurs when the blood flow to the brain is somehow disrupted and brain cells lose their supply of nutrients. This happens when the brain receives too little, or too much, blood. If this problem is not fixed within a short time - usually hours - brain cells will die and you will be left with permanent brain damage. Once brain cells die, they cannot be regrown or revitalized.

There are two types of stroke - ischemic stroke and hemorrhagic stroke. Ischemic stroke is more common and occurs when blood flow to the brain is blocked. Hemorrhagic stroke is less common, but more deadly, and occurs when there is bleeding into or around the brain itself. Hemorrhagic stroke includes both intracerebral hemorrhage and subarachnoid hemorrhage. Further discussion will explain the causes, diagnosis and treatment of the different types of stroke.

Blood Flow to the Brain

Your heart pumps blood up to the brain through two sets of arteries, the carotid arteries and the vertebral arteries. The carotid arteries can be found in the front of your neck and are what you feel when you take your pulse just under your jaw. The carotid artery splits into the external and internal arteries near the top your neck with the external carotid artery supplying blood to your face and the internal carotid artery going into the skull. Once in the skull, the internal carotid artery branches to form two large arteries - the anterior cerebral and middle cerebral arteries - and several smaller arteries — the ophthalmic, posterior communicating, and anterior choroidal arteries. These arteries supply blood to the front two-thirds of your brain.

The vertebral arteries come up along side your spinal column and cannot be felt from the outside. The vertebral arteries join to form a single basilar artery near the brain stem, which is located near the base of your skull. The vertebrobasilar system sends many small branches into the brain stem and branches off to form the posterior cerebellar and posterior meningeal arteries, which supply the back third of your brain. The jugular, and other, veins bring blood out of the brain.

Because the brain relies on only two sets of major arteries for its blood supply, it is very important that these arteries are healthy. Often when an ischemic stroke occurs, the carotid or vertebral artery system is blocked with a fatty build up called plaque, allowing little or no blood to flow to the brain. During a hemorrhagic stroke, an artery in or on the surface of the brain has ruptured or is leaking, causing bleeding and damage in or around the brain.

Risk Factors

The best treatment for stroke is to prevent a major cerebrovascular event from occurring in the first place. The following risk factors can be modified to help reduce the risk of stroke:

Hypertension

High blood pressure is the leading cause of both ischemic and hemorrhagic strokes. High blood pressure should be treated and kept to a level below 140/90 mm/Hg. Both the upper and lower numbers are important. The faithful following of a blood pressure treatment plan can help prevent a stroke.

Cigarettes

Smoking doubles your chance of suffering a stroke.

WEIGHT Obesity increases your chance of suffering hypertension and high blood cholesterol, a factor in developing carotid stenosis. Even modest weight gain (24 to 43 pounds over 16 years) can almost double your chances of suffering a stroke.

Carotid Stenosis

The build up of fatty plaque on the insides of the carotid artery increases your chances of suffering an ischemic stroke.

Elevated Cholesterol and Serum Cholesterol Levels

High cholesterol levels can promote carotid stenosis and lead to a stroke. A healthy diet and medications prescribed by your primary care physician can help reduce cholesterol levels to below 200.

Making lifestyle changes and following treatment plans prescribed by your primary care physician can decrease your chances of suffering a stroke more than tenfold.

Warning Signs

There are also "warning signs" of an impending stroke, and stroke often does not strike unannounced.

* Prior stroke. Stroke can strike a person twice. Suffering one stroke, regardless of its severity, increases your chances of suffering a second stroke.

* TIA (transient ischemic attack). A TIA is a temporary cerebrovascular disruption that leaves no permanent damage. These are recognizable events and can be a predictor of a future, more devastating stroke.

* Headache. A severe, sudden, unusual headache can be a sign of an hemorrhagic stroke and requires immediate medical attention.

Although neurosurgeons treat all types of acute stroke, there are four risk factors, warning signs and conditions that are best recognized and treated by a neurosurgeon before acute stroke occurs: TIAs, carotid stenosis, aneurysms and vascular formations.

Transient Ischemic Attacks (TIAs)

A TIA is a temporary cerebrovascular event that leaves no permanent damage. Most likely an artery to the brain became temporarily blocked, causing stroke-like symptoms, but the blockage was dislodged before any permanent damage was done.

It is very important that TIAs are recognized and treated, and they should be viewed as an opportunity for medical professionals to intercede and prevent a major stroke. If you experience TIA symptoms, seek emergency medical help and notify your primary care physician

immediately. Approximately 30 percent of all people who suffer a major stroke experience a prior TIA and 10 percent of all TIA victims suffer a stroke within two weeks. The sooner you seek medical attention, the sooner a diagnosis and treatment can be made.

Symptoms of a TIA are often vague and hard to recognize. Symptoms can be quite brief and usually last from 2 to 30 minutes. Symptoms of TIA include:

- * Visual disturbances, including blocked or loss of vision in one eye, blurry vision or “graying”
- * Weakness, numbness or clumsiness in one arm or hand
- * Language problems, including slurred speech or speaking jibberish
- * Facial droop/weakness
- * Unusual dizziness, vertigo and overall numbness may also indicate a vertebrobasilar TIA and should be reported to your physician immediately.

TIAs can be caused by blockage in the major arteries supplying blood to the brain, blockage of a small artery in the brain or by cardiac problems. Diagnostic imaging test can help determine the cause of a TIA.

While there is no treatment for the TIA itself, it is essential that the source of the TIA be discovered and appropriately treated before another event occurs. Treatment options for TIA patients focus on treating carotid artery disease (please see following section) or treating cardiac problems.

If you suffer a TIA, you are at higher risk for suffering a major stroke and should understand the signs and symptoms of stroke in order to act quickly. Early recognition and fast treatment are essential to effectively treating a stroke.

Carotid Stenosis

Carotid artery disease refers to plaque building up on the artery wall. The body’s natural reaction is to heal over it — much like a scab forming over a cut. This condition is called arteriosclerosis – atheroma is the plaque material that builds up, and sclerosis refers to the body’s reaction to harden the material. The material accumulates and narrows the artery. The narrowing is referred to as stenosis, which is measured in percentage of the diameter of the artery blocked (i.e., 70 percent stenosis means the artery is 70 percent blocked).

Early warning signs of stenosis can be detected by a primary care physician during a regular physical exam and include the presence of a carotid bruit. Carotid bruits are the noise made by the blood flowing past the blockage. The disturbed flow creates turbulence that can be heard by the physician listening to the artery with a stethoscope.

If you are experiencing symptoms because of the stenosis, you are considered "symptomatic." There are several diagnostic studies that can determine if you have stenosis and to what degree. You may also have very significant stenosis, but not have any symptoms and would therefore be considered "asymptomatic." Patients with any level of stenosis should be monitored on a regular basis so any changes in the degree of stenosis, regardless of treatment plan, can be noted and treated appropriately.

For patients with less than 50 percent stenosis, medical therapy is often prescribed. There are drugs that interfere with the formation of a blood clot, called anticoagulant drugs ("blood thinners"). These drugs include heparin and coumadin (also called Warfarin). There are also

medications that interfere with a cell fragment called a platelet that is involved in blood clotting. Drugs that interfere with platelet function (antiplatelet drugs) include including aspirin, Ticlopidine and Plavix.

Patients with over 50 percent stenosis can often best reduce their risk of stroke with surgical therapy. The plaque buildup in the artery can be removed in a surgical procedure called carotid endarterectomy. The goal of this procedure is to prevent a major stroke. Two major scientific studies have proven the effectiveness of this procedure. They show that patients with more than 70 percent stenosis reduce their relative risk of stroke by 55 percent and patients with between 50 to 69 percent stenosis reduce their relative risk by 35 percent.

During a carotid endarterectomy, the neurosurgeon exposes and opens the carotid artery, removes the plaque and closes the artery. You will often be hospitalized for about 48 hours after the procedure. Complication rates for carotid endarterectomy are approximately 3 percent, but individual risks should always be discussed with your surgeon before the procedure.

Certain features of stenosis -- such as the size of the artery and location of the blockage, or certain medical conditions in your history may call for a different treatment called carotid stenting. In this procedure, a small, tube-like support or stent is threaded up to the narrowing artery from the groin (in the same way the angiography catheter is inserted). The stent is expanded and opens the narrowing. This procedure has not undergone the rigorous evaluation that carotid endarterectomy has, but may be the best option for selected patients.

Aneurysms

An aneurysm is a thin-walled dilation off of an artery. They typically develop where an artery branches and the wall is inherently weak. The aneurysm starts as a small bubble or enlargement, but can grow to several centimeters in diameter. Common sites for aneurysms are off the branches of the internal carotid artery, along the upper branches of the basilar artery and near the junction of the anterior cerebral arteries.

Aneurysms are at risk for leaking or rupturing. If blood is released into the cerebro-spinal fluid space that surrounds the brain (the subarachnoid space) a subarachnoid hemorrhage (SAH) occurs. If the rupture of the aneurysm directs a jet of blood into the brain tissue, a blood clot forms within the brain and this is called a intracerebral hemorrhage (ICH).

Approximately 30 percent of all people who suffer SAH die before even reaching medical facilities. Of those treated, only 60 percent have a good outcome. The rest will be disabled or die of the complications caused by the bleeding. Because of these devastating facts, it is often beneficial to discover and treat aneurysms before they rupture.

Aneurysms are normally diagnosed through an angiography. A CT scan is used to show if a subarachnoid hemorrhage has occurred in the brain. Sometimes, bleeding in the brain is minimal and will not show up on the CT scan. A spinal tap, or lumbar puncture, can be used to verify if there is any blood in the cerebrospinal fluid.

Some aneurysms are incidentally discovered, perhaps during an angiogram for carotid artery disease, and have not produced any symptoms or problems. In other cases, as the aneurysm grows, it compresses surrounding nerves and brain structures and causes symptoms including blurred vision, double vision or headache. Regardless of the size of the aneurysm or whether the aneurysm is producing symptoms, all aneurysms need prompt evaluation by a neurosurgeon.

Appropriate treatment depends on the size and location of the aneurysm and other factors in your medical history. Risk of rupture increases with the size of the aneurysm and time.

The most direct and common treatment performed is to "clip" the aneurysm. The neurosurgeon uses microsurgical techniques to identify the "neck" of the aneurysm, and by placing a small metal clip on the neck, prevents blood flow from entering the "dome" of the aneurysm. These clips are designed to be left in place permanently, eliminating the risk of rupture.

Sometimes treatment of an aneurysm may be possible without opening the skull, but instead from inside the blood vessel itself. This treatment is called neuroendovascular therapy. Coils are inserted into the aneurysm through a catheter that has been thread up into the artery. The coils slow the blood flow and help a clot form within the aneurysm, essentially sealing off the aneurysm. Hopefully, the lining of the blood vessel will grow over the aneurysm. Not all patients are candidates for neuroendovascular therapy, primarily because of the anatomy of the individual aneurysm. Neurosurgeons and neuroendovascular specialists work as a team to perform this procedure.

Because of various factors, it is possible that you and your neurosurgeons may decide together that surgery is not the best option for you at this time. It is important to note that aneurysms do not "go away" and, if immediate treatment is not provided, it is essential that you follow-up regularly with your neurosurgeon to observe changes in the size and structure of the aneurysm.

Vascular Malformations

The term vascular malformation refers to an abnormal connection of an artery, vein, or both. They include malformations of normal veins (venous angioma), or arteries going directly to veins (arteriovenous malformations, or AVMs). These malformations are formed as the blood vessels in brain develop during pregnancy, but the direct cause is unknown. Preventing the rupture of vascular malformations is one of the major reasons that early neurosurgical treatment is recommended for these disorders.

AVMs are usually diagnosed through a combination of MRI and angiography. AVMs can irritate the surrounding brain and cause seizures or headaches. Left untreated, AVMs can enlarge and rupture, causing an intracerebral or subarachnoid hemorrhage and permanent brain damage.

A treatment plan is devised to offer the lowest risk yet highest chance of obliterating the lesion. The three types of treatment available include direct removal using microsurgical techniques, stereotactic radiosurgery and embolization using neuroendovascular techniques. Although microsurgical treatment affords the opportunity for immediate removal of the AVM, some AVMs may best be treated by a combination of therapies.

Stereotactic radiosurgery is a minimally invasive treatment that uses computer guidance to concentrate radiation to the malformed vessels in the brain. This radiation causes abnormal vessels to close off. Unfortunately, stereotactic radiosurgery is usually limited to lesions less than 3.5 cm in diameter, and may take up to two years to completely obliterate the lesion.

Embolization uses neuroendovascular techniques to guide tiny catheters into the small cerebral vessels of the brain that feed the AVM. Once the catheter reaches the core of the AVM, liquid glue or particles can be injected to occlude portions of the AVM or its feeding arteries. Neuroendovascular therapy can make subsequent surgical removal of an AVM safer, or can reduce the size of an AVM to a volume in which radiosurgery offers a higher efficacy.

Symptoms of Stroke

The single most important factor in treating an acute stroke is time. Stroke is an emergency. Stroke victims need urgent medical care. Call 9-1-1 if you think you, or someone else, is experiencing a stroke.

Symptoms of stroke include:

Visual Disturbances, including blocked or loss of vision in one eye, blurry vision or "graying"

"It seemed like someone was pulling a shade over one of my eyes."

Weakness, numbness or clumsiness in one arm or hand

"My arm wouldn't do what I wanted it to do."

"I couldn't hold on to my coffee cup."

"I couldn't lift up my arm."

"My arm felt tingly."

Language Problems, including slurred speech

"I just couldn't say anything."

"She sounded drunk."

"My family couldn't make sense of what I was saying." Facial Droop/Weakness

"The left side of my face was sagging."

Dizziness, stumbling

"I couldn't walk straight."

Severe, sudden headache

"I have the worst headache of my life."

If there is any doubt whether you, or someone around you, is experiencing a stroke, seek immediate medical attention.

Stroke can be caused by either a blockage in the arteries leading to the brain (an ischemic stroke) or bleeding in the brain itself (ahemorrhagic stroke). There are two types of ischemic stroke and two types of hemorrhagic stroke.

Treatment of Ischemic Stroke

A thrombotic stroke occurs when a build up of plaque and blood clot, called a thrombus, blocks an artery to the brain and stops blood flow. An embolic stroke occurs when a piece of plaque or thrombus travels from its original site and blocks an artery downstream. The material that has moved is called an "embolus". How much of the brain is damaged or affected depends on exactly how far downstream in the artery the blockage occurs.

In most cases, the carotid or vertebral arteries do not become completely blocked and a trickle of blood does make its way to the brain. The reduced blood flow to the brain starves the cells of nutrients and quickly leads to the cells malfunctioning. As a part of the brain stops functioning,

you feel symptoms of a stroke. During a stroke, there is a "core" area where blood is almost completely cut off and the cells die within 3-5 minutes. However, there is a much larger area known as the ischemic penumbra that surrounds the core of dead cells. The ischemic penumbra consists of cells that are impaired and not functioning, but are not dead. These cells are called "idling cells", and they can survive in this state for around three hours.

There are new treatments available to help rescue cells in this ischemic penumbra, treat stroke and stop permanent brain damage, including a drug therapy called tPA (tissue plasminogen activator). These therapies must be given within three hours of the onset of symptoms. However, before drug therapies can be given, a CT scan must be obtained to rule out any bleeding in the brain. This takes precious time. The sooner you get to the hospital, the better chance you have for a good outcome.

In a recent National Institute of Neurological Disorders and Stroke (NINDS) study, patients who received tPA were at least 30 percent more likely than untreated patients to recover from their stroke with little or no disability. However, only a little more than 4 percent of patients suffering a stroke arrived at the hospital in time to receive treatment. This delay is a direct result of victims not recognizing symptoms. This is something you can help fix. All stroke victims should make it to the hospital in time to be eligible to receive tPA, which can make the difference between making a complete recovery and being permanently disabled.

Treatment of Hemorrhagic Stroke

A hemorrhagic stroke can be caused by hypertension; rupture of an aneurysm or vascular malformation; or as a complication of anticoagulation medications. An intracerebral hemorrhage occurs when there is bleeding directly into the brain tissue, usually forming a clot within the brain. A subarachnoid hemorrhage occurs when the bleeding is into the cerebrospinal fluid spaces around the brain. Both conditions are very serious.

In some cases, neurosurgeons can use microsurgical or stereotactic techniques to remove the blood clot formed during an intracerebral hemorrhage. Medical and surgical management of intracranial pressure can also prevent permanent brain damage. Whatever treatment is chosen, it does appear that patients who are evaluated and treated earlier have better outcomes.

Patients experiencing subarachnoid hemorrhage require immediate neurosurgical treatment. Depending on the size and location of the aneurysm, microsurgical clips or neuroendovascular coils may be utilized. After treatment, SAH patients are monitored in intensive care for complications, including vasospasm and hydrocephalus.

Blood in the cerebrospinal fluid after SAH can lead to the spontaneous constriction of the arteries on the surface of the brain. This is called vasospasm. When vasospasm occurs, the blood flow to the brain can be choked off by the constricting arteries, causing extensive strokes. SAH patients are at risk for vasospasm between 4 – 14 days after rupture. Hydrocephalus is the build up of cerebrospinal fluid in and around the brain. A subarachnoid hemorrhage can interfere with the normal absorption of the cerebrospinal fluid and cause hydrocephalus. Hydrocephalus usually progresses slowly over the months following a SAH and patients may complain of headache, drowsiness or other neurological problems. A CT scan detects hydrocephalus and a neurosurgeon can treat this condition with a shunt to restore the proper drainage of cerebrospinal fluid from the brain.

Regardless of what type of stroke has been suffered, it is critical that victims receive emergency medical treatment as soon as possible for the best possible outcome to be realized. By learning the signs and symptoms of stroke and preventatively treating risk factors, you can help stop the devastating results this disease leaves behind.