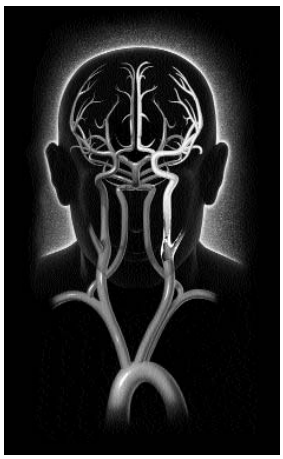
What is a Stroke/Brain Attack?

A stroke or "brain attack" occurs when a blood clot blocks the blood flow in a vessel or artery or when a blood vessel breaks, interrupting blood flow to an area of the brain. When either of these things happens, brain cells begin to die.

When brain cells die during a stroke, abilities controlled by that area of the brain are lost. These include functions such as speech, movement, and memory. The specific abilities lost or affected depend on the location of the stroke and on its severity (i.e., the extent of brain cell death).

For example, someone who has a small stroke may experience only minor effects such as weakness of an arm or leg. Someone who has a larger stroke may be paralyzed on one side or lose his/her ability to speak. Some people recover completely from less serious strokes, while other strokes can be fatal.

BRAIN ATTACK!



- **Stroke is a "Brain Attack"**
- **Stroke happens in the brain rather than the heart**
- **Stroke is an emergency**
- **"Time is Brain"**

For complete and accurate information on stroke, call

National Stroke Association

1-800-STROKES (800-787-6537)

www.stroke.org

Why Use the Term Brain Attack?

National Stroke Association (NSA) began to champion the term "brain attack" in 1990 because it characterizes stroke more clearly to the public. The origination of the term and its application to stroke are credited to Vladimir C. Hachinski, M.D., and John Norris, M.D., both world-renowned neurologists from Canada. The brain is the most delicate organ in the body. "To give the best chance of limiting damage, brain attacks should be heeded even more urgently than heart attacks," said Dr. Hachinski.

The symptoms of stroke should have the same alarming significance in identifying a brain attack that severe, specific chest pain has in identifying a heart attack.

The appropriate response to a brain attack is emergency action, both by the person it strikes and the medical community.

Brain Attack Means Medical Emergency

Educating the public to treat stroke as a brain attack and to seek emergency treatment is crucial. Every minute people lose getting treatment increases the chances of them experiencing stroke-related disabilities or death. The majority of patients don't arrive at the emergency room until more than 24 hours after they experience stroke symptoms.[1] The only FDA-approved treatment for stroke, a clot-busting drug, must be administered within three hours of the first signs of stroke.

One of the largest obstacles to emergency treatment is that many people don't know they are having a stroke. The University of Cincinnati reported that 52 percent of their acute stroke patients were unaware they were experiencing a stroke. That is why it is critical for everyone to "Be Stroke Smart" and learn the 3 **R's** of stroke: **R**educe risk, **R**ecognize symptoms, **R**espond by calling 911.

CHANGING THE PERCEPTION OF STROKE

Myth	*Reality*
u **Stroke is not preventable**	u **Almost 80% of strokes are preventable**
u **Stroke cannot be treated**	u **Stroke requires emergency treatment**
u **Strokes only strike the elderly**	u **Strokes can happen to anyone of any age**
u **Stroke happens to the heart**	u **Stroke occurs in the brain**
u **Stroke recovery happens for a few months post-stroke**	u **Stroke recovery can continue throughout life**

Brain Attack Statistics

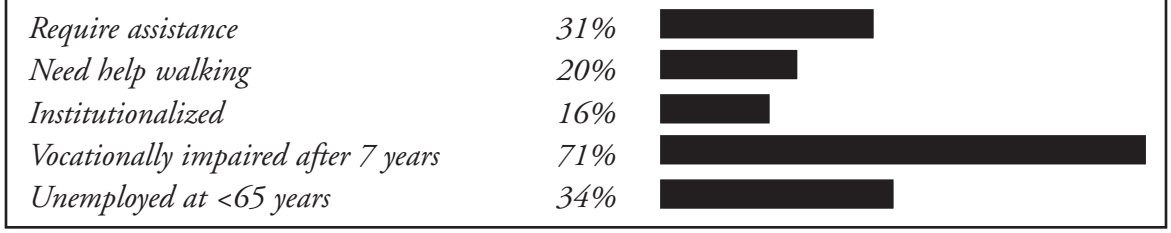
The Cost of Stroke to Americans

- Stroke is our nation's third leading cause of death, killing 160,000 Americans every year.[3]
- Every year more than 750,000 Americans have a new or recurrent stroke.[2]
- Every forty-five seconds in the United States, someone experiences a stroke.
- Over the course of a lifetime, four out of every five American families will be touched by stroke.[4]
- Approximately one-third of all stroke survivors will have another stroke within five years.[5]
- Of the 590,000 Americans who survive a stroke each year, approximately 5 to 14 percent will have another stroke within one year. The rate of having another stroke is about 10 percent per year thereafter.[6]

Time After Risk	Cumulative
30 days	*3% to 10%*
1 year	*5% to 14%*
5 years	*25% to 40%*

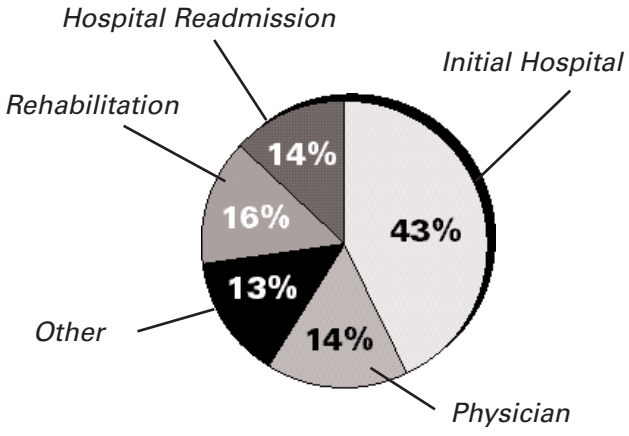
- Stroke is the leading cause of adult disability. Over four million Americans are living with the effects of stroke. About one-third have mild impairments, another third are moderately impaired and the remainder are severely impaired.[4]

Toll among 2,930,000 survivors in 1991 (Framingham Study)[8]



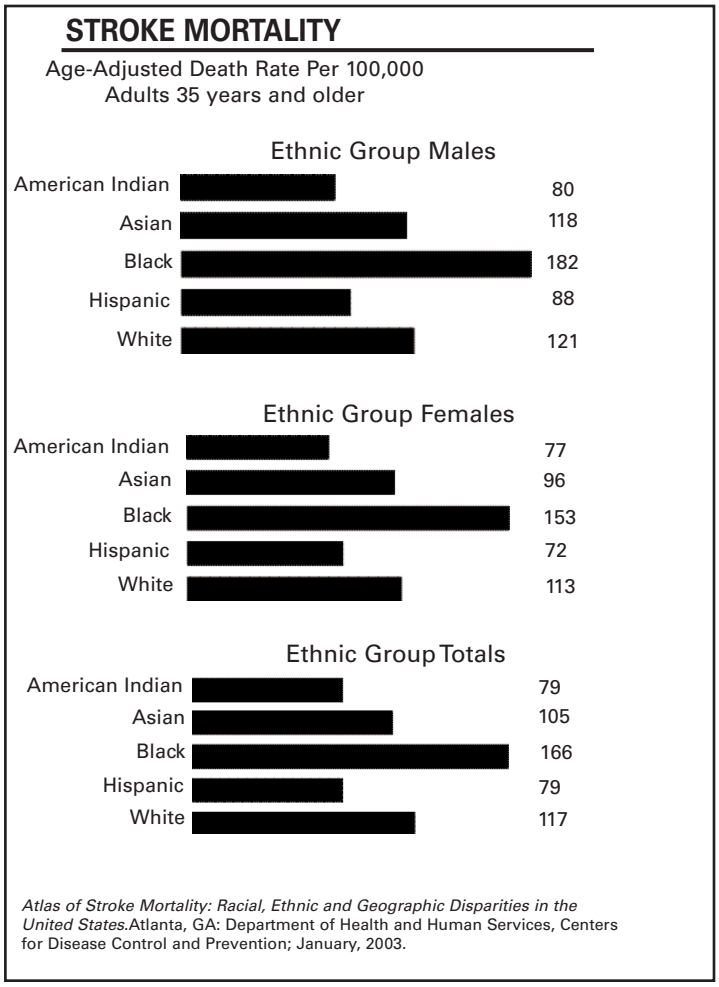
- Stroke costs the United States more than $52 billion annually. Direct costs, such as hospitals, physicians and rehabilitation add up to $32 billion; indirect costs, such as lost productivity, total $20 billion. The average cost per patient for the first 90 days post-stroke is $15,000, although 10 percent of the cases exceed $35,000.[9]

Clot-caused Stroke Costs for the First 90 Days[9]



Stroke: A Leading Cause of Death

Stroke remains the third leading cause of death in the United States, killing more American women each year than breast cancer. The other two leading killers are heart disease and cancer.



Atlas of Stroke Mortality: Racial, Ethnic and Geographic Disparities in the United States. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention; January, 2003.

The Poor Public Awareness of Stroke

A 1996 NSA/Gallup Survey on stroke awareness in the United States revealed the following[10]:

- Among adults age 50 or older, 38 percent did not know that stroke occurs in the brain.
- 19 percent were unaware that many strokes can be prevented.
- Only 40 percent would call 911 immediately if they were having a stroke.
- Two-thirds were unaware of the short time frame in which a per son must seek treatment.
- Only 8 percent correctly defined a Transient Ischemic Attack (TIA) as a small stroke.

The survey also showed that older Americans could not identify the following stroke symptoms:

- Sudden blurred or decreased vision in one or both eyes – 91 percent
- Loss of balance or coordination (a major sign when accompanied by another symptom) – 85 percent
- Difficulty speaking or understanding simple statements – 68 percent
- Weakness/numbness/paralysis in the face, arm or leg – 42 percent

The Toll on Older Adults

- Stroke risk increases with age. For each decade after age 55, the risk of stroke doubles.[5]
- For adults over age 65, the risk of dying from stroke is seven times that of the general population.[5]
- Two thirds of all strokes occur in people over age 65.[11]

The Toll on Women

- Twice as many women die from stroke than from breast cancer every year.
- Two-thirds of American women don't know stroke symptoms or that they must get immediate medical treatment.
- One-third of strokes in women occur in those under the age of 65.
- 100,000 young and middle-aged women will suffer a stroke this year.
- African American women have the highest rate of stroke prevalence among the three major female ethnic groups, including Caucasians and Hispanics.
- Women who smoke and take birth control pills are four times more likely to have a stroke.[12]
- Stroke has a disproportionate effect on women. Women account for approximately 43 percent of the strokes that occur each year, yet they account for 61 percent of stroke deaths.[3]

The Toll on African Americans

- The incidence rate for first stroke among African Americans is almost double that of Caucasians – 288 per 100,000 African Americans, compared to 179 per 100,000 whites.[3]
- African Americans suffer more extensive physical impairments that last longer than those of other racial groups in the United States.[14]
- African Americans are also twice as likely to die from a stroke. Stroke mortality for this group is nearly double that for whites.[3, 13]
- African Americans have a disproportionately high incidence of risk factors for stroke, particularly hypertension, diabetes, obesity, smoking and sickle cell anemia.[3]

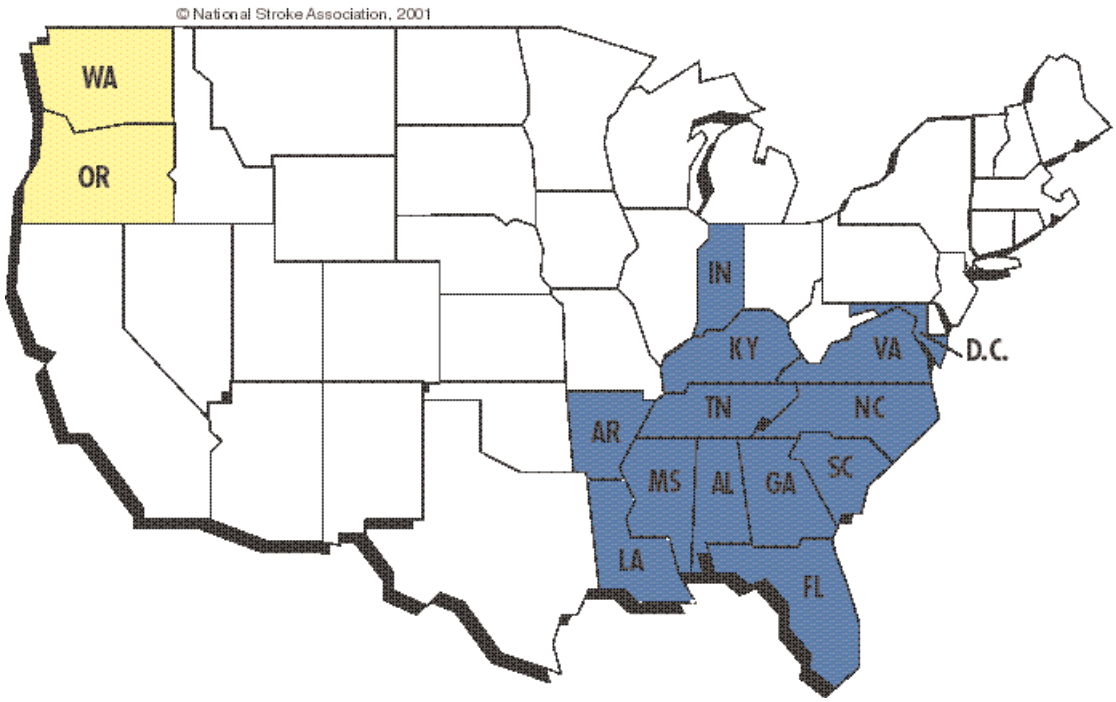
The "Stroke Belt"

Twelve contiguous states and the District of Columbia have stroke death rates that are consistently more than 10 percent higher than the rest of the country. These states (Alabama, Arkansas, Florida, Georgia, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia) along with Washington, D.C., are often referred to as the "stroke belt." Their higher incidence and mortality may be linked to a number of factors, including[14]:

- A higher than average population of African Americans
- A higher than average population of older adults
- Dietary factors

Another "stroke belt" may also be developing in Washington and Oregon, according to a study from the Centers for Disease Control and Prevention. However, further research needs to be done to determine the causes and increases in stroke rates in these areas.

The Stroke Belt



Brain Attacks and Prominent People

Famous leaders and celebrities who have experienced strokes:

- Mary Kay Ash - Cosmetics entrepreneur v
- Les Aspin - Former U.S. Defense Secretary v
- Laverne Baker - Rock & roll singer v
- Anne Baxter - Actress v
- Barbara Bel Geddes - Actress
- Joseph Biden - U.S. Senator
- Ray Bradbury - Author
- Justice William Brennan - Supreme Court Justice v
- Art Buchwald - Pulitzer Prize-winning humorist
- Harry Caray - Sports commentator v
- Margaret Chase Smith - Politician v
- Winston Churchill - Former Prime Minister of England v
- Adolphus "Doc" Cheatham - Jazz trumpeter v
- Claudette Colbert - Actress v
- Joseph Cotten - Actor v
- Paul Coverdell - Former U.S. Senator v
- Cassandra Danson - Ex-wife of actor Ted Danson
- Bette Davis - Actress v
- Agnes de Mille - Actress/choreographer v
- Charles Dickens - Novelist v
- Kirk Douglas - Actor
- Dwight Eisenhower - Former U.S. President
- Dale Evans - Cowgirl performer v
- Federico Fellini - Italian film director v
- Gerald Ford --Former U.S. President
- William Fulbright - Former U.S. Senator
- Alan Funk - TV Producer/Host v
- Ava Gardner - Actress v
- Pauline Gore - Vice President Al Gore's Mother
- Glenn Gould - Classical pianist v
- Cary Grant - Actor v
- Robert Guillaume – Actor
- Ernest Hamilton - Father of Olympic gold medalist Scott Hamilton v
- Lionel Hampton - Vibrophonist
- Warren G. Harding - Former U.S. President v
- Pamela Harriman - U.S. Ambassador to France v
- Hugh Heffner - Magazine Publisher
- Rick James – Singer
- Thomas Jefferson - Former U.S. President v
- Lady Bird Johnson (Claudia Taylor) - Former First Lady
- Marv Johnson - Motown singer v
- Grandpa Jones (Louis Marshall) - Actor v
- Quincy Jones - Record producer
- Raul Julia - Actor v
- Ken Kelsey - Author
- Ruby Keeler - Actress v
- Gene Kelly - Actor/dancer v
- Rose Kennedy - Kennedy family matriarch v
- Ed Koch - Former Mayor of New York City
- Burt Lancaster - Actor v
- Burton Lane - Composer v
- Jonathan Larson - Pulitzer Prize-winning playwright v
- William Leonard - Former CBS News President v

v = deceased individuals

Other famous leaders and celebrities who have experienced strokes:

- Princess Margaret - Sister of Queen Elizabeth v
- Darin McGavin- Actor v
- David Merrick - Broadway producer v
- Empress Michiko - Empress of Japan
- Thelonius Monk - Jazz musician v
- Bill Monroe - Father of bluegrass music v
- Patricia Neal - Actress
- Pat Nixon - Former First Lady v
- Richard Nixon - Former U.S. President
- Minnie Pearl - Country music performer v
- Oscar Peterson - Jazz pianist
- Martha Raye - Actress/singer v
- Ben Vereen - Entertainer
- Deng Xiao Ping - Chinese political leader v
- Della Reese - Actress/singer
- J.R. Richard - Major league baseball player
- Hugh Rodham - Father of First Lady Hilary Rodham Clinton v
- Ginger Rogers - Dancer/actress v
- Franklin D. Roosevelt - Former U.S. President v
- Robert Shaw - Conductor, Atlanta Symphony v
- Josef Stalin - Russian leader v
- Willie Stargell - Baseball legend v
- Robert Lewis Stevenson - Author v
- Potter Stewart - Former Supreme Court Justice v
- Bill Tavoulareas - Former Mobil Oil President v
- Mel Torme - Singer v
- Jackie Mayer Townsend - Miss America 1963
- Fred Waring - Pennsylvanians' conductor v
- Ted Williams - Major league baseball player v
- Woodrow Wilson - Former U.S. President

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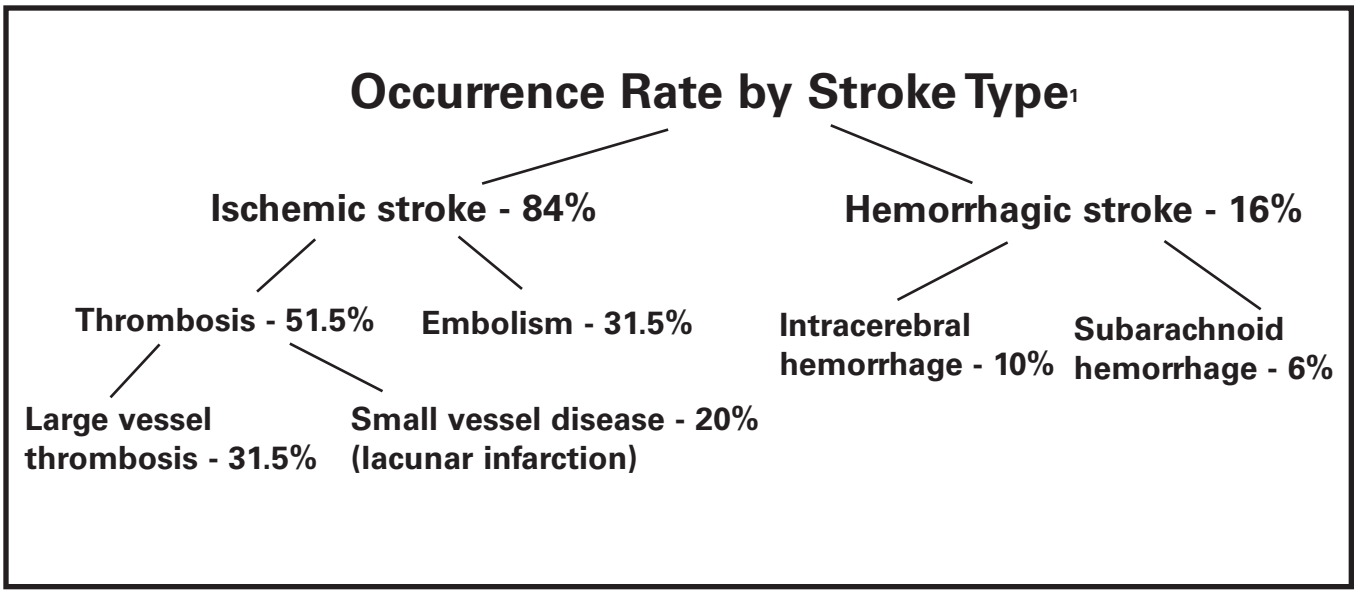
Types of Stroke

There are two types of "brain attacks" — ischemic and hemorrhagic. With ischemic strokes, a blood clot blocks or "plugs" a blood vessel in the brain. With hemorrhagic strokes, a blood vessel in the brain breaks or ruptures.



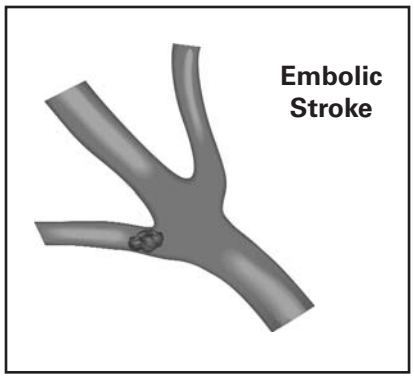
Ischemic Stroke

Ischemic strokes are the most common kind of stroke causing 84 percent of all strokes. *Please note: throughout this book, most treatment and prevention strategies refer to ischemic rather than hemorrhagic stroke.*

In everyday life, blood clotting is beneficial. When you are bleeding from a wound, blood clots work to slow and eventually stop the bleeding. In the case of stroke, however, blood clots are dangerous because they can block arteries and cut off blood flow to the brain, a process called ischemia. An ischemic stroke can occur in two ways — embolic and thrombotic strokes.

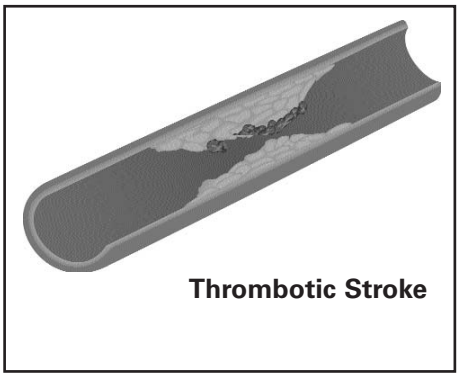
Embolic Stroke

In an embolic stroke, a blood clot forms somewhere in the body (usually the heart) and travels through the bloodstream to your brain. Once in your brain, the clot eventually travels to a blood vessel small enough to block its passage. The clot lodges there, blocking the blood vessel and causing a stroke. The medical word for this type of blood clot is embolus.



Thrombotic Stroke

In the second type of ischemic stroke, blood flow is impaired because of a blockage to one or more of the arteries supplying blood to the brain. The process leading to this blockage is known as thrombosis. Strokes caused in this way are called thrombotic strokes. That's because the medical word for a clot that forms on a blood-vessel deposit is thrombus.



Thrombotic Stroke

Blood-clot strokes can also happen as the result of unhealthy blood vessels clogged with a buildup of fatty deposits and cholesterol. Your body regards these build-ups as multiple, tiny and repeated injuries to the blood vessel wall. So your body reacts to these injuries just as it would if you were bleeding from a wound—it responds by forming clots.

Transient Ischemic Attacks (TIAs)

TIAs — Stroke Warnings

Transient ischemic attacks, or TIAs, are brief episodes of stroke symptoms resulting from temporary interruptions of blood flow to the brain. TIAs can last anywhere from a few seconds up to 24 hours. Unlike actual strokes, TIAs do not kill brain cells, and therefore, do not result in permanent brain damage. However, they can be warning signs of an impending stroke.

The symptoms of a TIA are the same as for a stroke:

- Sudden numbness of face, arm or leg, especially on one side of the body
- Sudden trouble seeing in one or both eyes
- Sudden confusion, trouble speaking or understanding
- Sudden trouble walking, dizziness, loss of balance or coordination
- Sudden severe headache with no known cause

If a person experiences any of these symptoms, for even the briefest amount of time, he or she should seek medical attention immediately. Urgent response to symptoms is important for two reasons:

- If you are having an actual stroke, emergency medical attention could save your life and greatly improve your chances for successful rehabilitation and recovery.
- If you are having a TIA, your doctor will evaluate and treat the underlying causes. Unfortunately, most people who have TIAs neglect to seek treatment, either because the symptoms are painless or because they choose to attribute their symptoms to old age, fatigue, etc. Only 42 percent of patients seek treatment within 24 hours of experiencing symptoms.[8]

TIAs should never be ignored! Approximately 10 percent of all strokes are preceded by TIAs.[10] Stroke risk increases ten-fold in someone who has had a TIA.[10] Fully one-third of all persons who experience TIAs will go on to have an actual stroke[11]. The first year after a TIA is an especially critical period [10,12]:

- 5 percent of those strokes will occur within one month of the TIA or previous stroke
- 12 percent will occur within one year
- 20 percent will occur within two years
- 25 percent will occur within three years

Recognizing Stroke Symptoms

Stroke is a brain attack, yet most people don't know the symptoms. In an NSA/Gallup poll, 17 percent of the respondents over age 50 couldn't name a single stroke symptom.

Stroke is an emergency! When someone experiences any of these symptoms, it is impossible to tell at first if it's a stroke or a transient ischemic attack (TIA). If it is a stroke, immediate medical treatment can save the person's life and greatly enhance chances for successful rehabilitation and recovery. If it's a TIA, the doctor will evaluate the underlying causes and begin preventive measures. Even if these symptoms don't cause pain or they go away quickly — **call 911 immediately**.

Sudden numbness or weakness of face, arm or leg, especially on one side of the body

Sudden confusion, trouble speaking or understanding

Sudden trouble seeing in one or both eyes

Sudden severe headache with no known cause

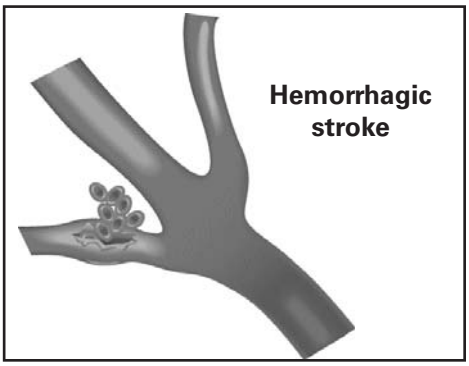
Sudden trouble walking, dizziness, loss of balance or coordination

Other Important but less common stroke symptoms include:

- Sudden nausea, fever and vomiting — distinguished from a viral illness by the speed of onset (minutes or hours vs. several days)
- Brief loss of consciousness or period of decreased consciousness (fainting, confusion, convulsions or coma)

Hemorrhagic Stroke

In an **ischemic stroke,** a blood clot or buildup of fatty tissue blocks or "plugs" a blood vessel in the brain. **Hemorrhagic stroke** occurs when a blood vessel in the brain breaks or ruptures spilling blood into the brain.



Hemorrhagic strokes account for about 15 percent of all strokes, yet are responsible for more than 30 percent of all stroke deaths.

Classification of Hemorrhagic Strokes

There are two types of hemorrhagic strokes – intracerebral (ICH) (within the brain's tissue) and subarachnoid (SAH) (around the brain's surface and under its protective layer).

While these two types of hemorrhagic strokes are similar, they generally arise from different causes.

Hemorrhagic Stroke Diagnosis

Immediate emergency attention is extremely important following any stroke. Once a patient arrives at the hospital, doctors are likely to use a computer imaging test such as a computed tomography (CT) scan or magnetic resonance imaging (MRI). These tests determine the type of stroke and the area of the brain that is affected. This information helps the doctor choose the best treatment. If doctors suspect a blood vessel abnormality, they may also perform an angiogram, an x-ray test that provides a picture of the blood vessels in the brain.

Hemorrhagic Stroke Risk Factors

> **High Blood Pressure**
High blood pressure is the most common cause of ICH, responsible for about 60 percent of all cases.[2] It is the most important controllable stroke risk factor. Have your blood pressure checked regularly. If it is consistently more than 140/90, speak with your healthcare provider about treatment options.

> **Alcohol and Drug Abuse**
Excessive alcohol and drug use have been associated with higher incidences of ICH and SAH.[3,4] About 85 to 90 percent of drug-associated ICH cases occur in people in their 20s or 30s.[3,4] If you drink alcohol, do so only in modera tion. If you don't drink, don't start.

> **Blood Anti-Clotting Medication**
Although anti-clotting medication may prevent ischemic stroke, if your blood becomes "too thin," you may be at risk for an ICH. Check with your doctor for guidance about anti-clotting medication.

> Blood Clotting Disorders

If you have any type of blood clotting disorder, such as hemophilia or sickle cell anemia, be sure to speak with your healthcare provider. There are ways you can control it to decrease your stroke risk.

Intracerebral Hemorrhage (ICH)

Intracerebral hemorrhage accounts for 10 to 15 percent of all strokes and is the most common type of hemorrhagic stroke.[5] It occurs when a vessel inside the brain ruptures, leaking blood into surrounding brain tissue.

Symptoms of ICH

One feature that nearly all ICH cases share is a sudden onset of symptoms. However, the signs that accompany this type of stroke are not always the same. Depending on the location and amount of bleeding in the brain, ICH symptoms may include:

> Partial or total loss of consciousness

> Vomiting or severe nausea, when combined with other symptoms

> Sudden numbness or weakness of face, arm or leg, especially on one side of the body

> Sudden severe headache with no known cause

Treatment

Treatment of ICH involves a variety of medical and surgical techniques, depending on the exact cause and size of the stroke. In cases where ICH is caused by high blood pressure, doctors first try to reduce the blood pressure. They then address the swelling or pressure that often builds up inside the head after the blood vessel ruptures.

In some cases, surgery may be needed to limit the damage to brain cells. Surgery is often performed when the patient has a good chance of recovering and the injured area of the brain is accessible.

Surgery may also be necessary for intracerebral hemorrhages caused by blood vessel problems such as an **arteriovenous malformation** (AVM).

An AVM is a tangle of thin-walled blood vessels, which can break more easily than normal, healthy vessels. AVMs are commonly associated with strokes at younger ages (20-40 years old), but the onset of their symptoms is usually not as fast or dramatic as the ones produced by an aneurysm rupture.[6] That is why doctors can often wait for a patient's condition to improve before performing surgery, or they may explore less risky and invasive treatment options such as radiation.

Subarachnoid Hemorrhage (SAH)

While an ICH causes blood to leak into the brain itself, a subarachnoid hemorrhage occurs when blood spills into the space surrounding the brain. This type of hemorrhage has many possible causes, but is usually the result of a ruptured **aneurysm.** An aneurysm is a balloon-like bulging of an artery's wall. As it enlarges, the vessel becomes weak and more likely to break.

More than half of the 30,000 strokes resulting from subarachnoid hemorrhages are caused by a ruptured aneurysm.[1, 6]

Symptoms

Typically, there are no warning signs of an SAH. Occasionally, an aneurysm is detected through a "warning leak." These small leaks may cause headaches weeks prior to a more damaging SAH. The symptoms of a SAH include:

> Sudden severe headache - often described as the "worst headache of my life"

> Vomiting or nausea, especially when combined with other symptoms such as headache

> Intolerance to light

> Stiff neck

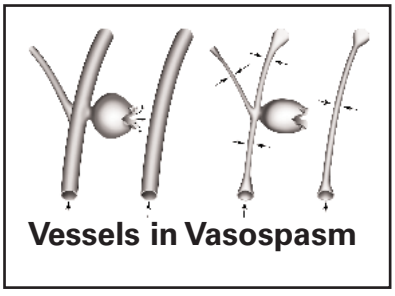
> Loss of consciousness, especially when combined with a severe headache

Treatment

Treatment of SAH (subarachnoid hemorrhage) targets the cause of bleeding and its related complications. Ruptured aneurysms are generally repaired in one of two ways – direct surgery to clip the aneurysm from the outside and seal the artery where the aneurysm was removed or treating the aneurysm from inside the vessel. Operating on the aneurysm from the inside is done by guiding a special catheter device through the brain until it reaches the aneurysm. Once there, the device reaches into the aneurysm and places a small metal-coil inside to stabilize the aneurysm wall and prevent blood from entering.

Embolized Aneurysm

A vessel-narrowing condition called vasospasm is also a common cause of death and disability following SAH. Vessels in vasospasm become irritated by blood and begin to spasm. As the vessels narrow, it becomes more difficult to supply surrounding brain tissue with enough blood to survive. This condition occurs in at least 30 percent of all subarachnoid hemorrhages and lasts for two or more weeks after the first vessel rupture.[7]



Vessels in Vasospasm

Vasospasm treatment often includes the use of the oral medication, nimpdipine. Taking the medication exactly as prescribed is critical to control the condition. Doctors may also manage vasospasm by closely monitoring the pressure, volume and concentration of blood in the brain.

Effects of Stroke

Intellect, sensation, perception and movement, all honed over the course of a lifetime, are the very abilities most compromised by stroke. Stroke can rob people of the most basic methods of interacting with the world.

The specific abilities that will be lost or affected by stroke depend on the extent of the brain damage and, most importantly, on the location of the stroke in the brain. The brain is an incredibly complex organ, and each area within the brain has responsibility for a particular function or ability. The brain is divided into four primary parts: the right hemisphere (or half), the left hemisphere, the cerebellum and the brain stem.

Right-Hemisphere Stroke

The right hemisphere of the brain controls the movement of the left side of the body. It also controls analytical and perceptual tasks, such as judging distance, size, speed, or position, and seeing how parts are connected to wholes.

A stroke in the right hemisphere often causes paralysis in the left side of the body, known as left hemiplegia. Survivors of right-hemisphere strokes may also have problems with their spatial and perceptual abilities. This may cause them to misjudge distances (leading to a fall) or be unable to guide their hands to pick up an object, button a shirt or tie their shoes. They may even be unable to tell right-side up from upside-down when trying to read.

Along with their impaired ability to judge spatial relationships, survivors of right-hemisphere strokes often have judgment difficulties that show up in their behavioral styles. These patients often develop an impulsive style, unaware of their impairments and certain of their ability to perform the same tasks as before the stroke. This behavioral style can be extremely dangerous. It may lead the stroke survivor with left-side paralysis to try to walk without aid. Or it may lead the survivor with spatial and perceptual impairments to try driving a car.

Survivors of right-hemisphere strokes may also experience left-sided neglect. Stemming from visual field impairments, left-sided neglect causes the survivor of a right-hemisphere stroke to “forget” or “ignore” objects or people on their left side.

Some survivors of right-hemisphere strokes will experience problems with short-term memory. Although they may be able to recount a visit to the seashore that took place 30 years ago, they may be unable to remember what they ate for breakfast that morning.

Left-Hemisphere Stroke

The left hemisphere of the brain controls the movement of the right side of the body. It also controls speech and language abilities for most people. A left-hemisphere stroke often causes paralysis of the right side of the body. This is known as right hemiplegia.

Someone who has had a left-hemisphere stroke may also develop aphasia. Aphasia is a term used to describe a wide range of speech and language problems. These problems can be specific, affecting only one part of the patient’s ability to communicate, such as the ability to move their speech-related muscles to talk properly. The same

patient may be completely unimpaired when it comes to writing, reading or understanding speech.

In contrast to survivors of right-hemisphere stroke, patients who have had a left-hemisphere stroke often develop a slow and cautious behavioral style. They may need frequent instruction and feedback to complete tasks.

Finally, patients with left-hemisphere stroke may develop memory problems similar to those of right-hemisphere stroke survivors. These problems can include shortened retention spans, difficulty in learning new information and problems in conceptualizing and generalizing.

Cerebellar Stroke

The cerebellum controls many of our reflexes and much of our balance and coordination. A stroke that takes place in the cerebellum can cause abnormal reflexes of the head and torso, coordination and balance problems, dizziness, nausea and vomiting.

Brain Stem Stroke

Strokes that occur in the brain stem are especially devastating. The brain stem is the area of the brain that controls all of our involuntary, "life-support" functions, such as breathing rate, blood pressure and heartbeat. The brain stem also controls abilities such as eye movements, hearing, speech and swallowing. Since impulses generated in the brain's hemispheres must travel through the brain stem on their way to the arms and legs, patients with a brain stem stroke may also develop paralysis in one or both sides of the body.

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Stroke Risk Factors and Their Impact

Stroke is one of the most preventable of all life-threatening health problems. Risk factors for stroke fall into two categories: those that can be controlled through lifestyle changes or medication and those that cannot. It's important to remember that having one or more uncontrollable stroke risk factors DOES NOT MAKE A PERSON FATED TO HAVE A STROKE. With proper attention to controllable stroke risk factors, the impact of uncontrollable factors can be greatly reduced.

Uncontrollable Stroke Risk Factors

Age

The chances of having a stroke increase with age. Two-thirds of all strokes happen to people over age 65. Stroke risk doubles with each decade past age 55.[1, 2]

Gender

Males have a slightly higher stroke risk than females. But, because women in the United States live longer than men, more stroke survivors over age 65 are women.[1]

Race

African Americans have a higher stroke risk than some other racial groups.[2] Hispanics also appear to have an increased risk of stroke, although not to the same degree as African Americans.[2]

Family history of stroke or Transient Ischemic Attack (TIA)

Risk is higher for people with a family history of stroke or TIA.[2]

Personal history of diabetes

People with diabetes have a higher stroke risk. This may be due to circulation problems that diabetes can cause. In addition, brain damage may be more severe and extensive if blood sugar is high when a stroke happens. Treating diabetes may help delay the onset of complications that increase stroke risk. However, even if diabetics are on medication and have blood sugar under control, they may still have an increased stroke risk simply because they have diabetes.[3]

Controllable Stroke Risk Factors

Treatable Medical Disorders that Increase Stroke Risk Include:

High Blood Pressure

Having high blood pressure, or hypertension, increases stroke risk four to six times.[2] It is the single most important controllable stroke risk factor. High blood pressure is often called "the silent killer" because people can have it and not realize it, since it often has no symptoms. Hypertension is a common condition, affecting approximately 50 million Americans, or one-third of the adult population.[4] Blood pressure is high if it is consistently more than 140/90. Between 40 and 90 percent of all stroke patients had high blood pressure before their stroke.[2] Hypertension puts stress on blood vessel walls and can lead to strokes from blood clots or hemorrhages.[4]

Heart Disease

Coronary Heart Disease and High Cholesterol

High cholesterol can directly and indirectly increase stroke risk by clogging blood vessels and putting people at greater risk for coronary heart disease, another important stroke risk factor. A cholesterol level of more than 200 is considered "high." Cholesterol is a soft, waxy fat in the bloodstream and in all of your body's cells. Your body naturally makes all the cholesterol it needs to form cell membranes, some hormones and vitamin D. In addition, certain foods (such as egg yolks, liver or foods fried in animal fat or tropical oils) contain cholesterol and saturated fats which increase cholesterol levels. High levels of cholesterol in the blood stream can lead to the buildup of plaque on artery walls, which can clog arteries and cause a heart or brain attack.

Atrial fibrillation

Heart disease such as atrial fibrillation increases stroke risk up to six times.[5] About 15 percent of all people who suffer stroke have a type of heart disease called atrial fibrillation, or AF. Affecting more than 2 million Americans,[6] AF is caused when the atria (the two upper chambers of the heart) beat rapidly and unpredictably, producing an irregular heartbeat. AF raises stroke risk because it allows blood to pool in the heart. When blood pools, it tends to form clots which can then be carried to the brain, causing a stroke.

Normally, all four chambers of the heart beat in the same rhythm somewhere between 60 and 100 times every minute. In someone with AF, the left atrium may beat as many as 400 times a minute. If left untreated, AF can increase stroke risk four to six times.[7] Over time, untreated AF can also weaken the heart, leading to potential heart failure. The prevalence of AF increases with age. AF is found most often in people over age 65 and in people who have heart disease or thyroid disorders. Among people age 50 to 59, AF is linked to 6.7 percent of all strokes. By ages 80-89, AF is responsible for 36.2 percent of all strokes.[8]

Personal history of stroke or TIA

People who have already had a stroke or TIA are at risk for having another. After suffering a stroke, men have a 42 percent chance of recurrent stroke within five years, and women have a 24 percent chance of having another stroke.[9] TIAs are also strong predictors of stroke because 35 percent of those who experience TIAs have a stroke within five years.[2]

Lifestyle Factors that Increase Stroke Risk Include:

Smoking

Smoking doubles stroke risk.[10] Smoking damages blood vessel walls, speeds up the clogging of arteries by plaque deposits, raises blood pressure and makes the heart work harder.

Alcohol

Drinking more than two drinks per day may increase your risk for stroke by almost half. Recent studies have also suggested that light to moderate alcohol consumption (up to two 4 oz. glasses of wine or the alcohol equivalent) may protect against stroke by raising levels of a naturally occurring "clot-buster" in the blood.[11,12] Alcohol is a drug and may interact with other medications. NSA's prevention guidelines recommend that if you currently don't already drink, don't start.

Weight

Excess weight puts a strain on the entire circulatory system. It also makes people more likely to have other stroke risk factors such as high cholesterol, high blood pressure and diabetes.[13]

Controlling High Blood Pressure

Because outward symptoms of hypertension are rare, it's important to have blood pressure checked regularly. According to the *Sixth Report of the Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure*, people should have their blood pressures checked at least every two years (more often if there is a history of high blood pressure).

Doctors may choose to treat hypertension (blood pressure consistently more than 140/90) in one or more of the following ways:

A low-salt diet

Too much salt may contribute to high blood pressure and make it more difficult to control. Doctors may ask people with high blood pressure to stop using table salt and to eat as many fresh foods as possible, since a lot of salt is "hidden" in processed or prepared foods. According to the National Heart, Lung and Blood Institute (NHLBI), if everyone in the United States ate 1 fewer teaspoon of salt each day, their collective blood pressures would drop enough to decrease the national stroke rate by 11 percent.

Other methods

In addition to a low-salt diet, doctors may choose to lower blood pressure by having patients lose weight, stop smoking and exercise regularly. These lifestyle modifications are often all that is needed to successfully control hypertension. For some patients, lifestyle modification will not adequately lower blood pressure, so their physicians may prescribe high blood pressure medication. [See page 27 for more information on antihypertensive medications.]

Controlling Heart Disease

Coronary Heart Disease and High Cholesterol

A doctor may choose to treat high cholesterol (more than 200 mg/dL) or prevent coronary heart disease by reducing cholesterol with one or more of the following methods:

Diet

According to the National Heart, Lung and Blood Institute (NHLBI), a diet with 30 percent or fewer total calories from fat and low in saturated fat is important for lowering cholesterol levels. This type of diet will likely include vegetables, lean meats such as chicken and fish, low-fat dairy products and a limited number of egg yolks. Adding fiber, such as whole grain bread, cereal products, raw unpeeled fruits and vegetables and dried beans, to the diet may also help reduce cholesterol levels by 6 to 19 percent.[37] In addition to diet, doctors may encourage a change in cooking habits, with an emphasis on baking, broiling, steaming and grilling rather than frying.

Exercise

According to the NHLBI, active people tend to have lower cholesterol levels. Regular exercise also seems to slow down or stop the clogging of blood vessels by fatty plaque deposits. Doctors may recommend a program of regular exercise to lower cholesterol. Aerobic exercise is best for lowering cholesterol because it strengthens the heart and lungs by maintaining an accelerated heart rate for an extended period of time. Walking, swimming and cycling are examples of aerobic exercise. For best results, exercise at an aerobic level at least three times a week for 20 to 30 minutes each time.

Atrial Fibrillation

Atrial fibrillation is a very important controllable stroke risk factor. Some people with AF will experience heart palpitations — often described as a "pounding," "racing" or "fluttering" heart beat. In other people, the only symptom of AF may be dizziness, faintness or light-headedness. Some may experience chest pains ranging from mild discomfort to severe pain. Others may experience no symptoms at all.

Self-test for irregular pulse

A recent nationwide study showed that 76 percent of the study participants could easily and quickly screen themselves to determine if they have an irregular pulse,[14] a telltale sign of AF. In the study, trained instructors taught participants how to find their own pulse and then identify the difference between a regular heartbeat and an irregular one.

This new, simple self-screening technique can be conducted on anyone to determine an irregular pulse. To properly self-screen for an irregular pulse, place the first two fingers of the right hand on the left wrist, then take the pulse to feel for a regular or irregular heartbeat. A regular heartbeat is characterized by a series of even, continuous beats, whereas an irregular heartbeat often feels like an extra or missed heartbeat. Keeping time by tapping the foot, may be helpful.

This self-screening technique must be performed properly in order to obtain correct results and should not be considered a substitute for consulting with a physician. If you are having difficulty locating your pulse or performing the screening technique, you may want to discuss your concerns with a physician.

All adults, especially those over the age of 55, should check their pulse every six months to determine if it is irregular.

AF, like high blood pressure or high cholesterol, often has no outward symptoms. The only way to completely confirm its presence is to perform an electrocardiogram (ECG).

During an ECG, sensitive electrodes are placed on the chest. These electrodes pick up the electrical impulses generated by the body that cause the heart to beat. The impulses are sent to a T.V. screen or a piece of paper called an ECG strip. By examining the specific pattern of electrical impulses, a doctor can determine whether a patient has AF. Doctors may choose to treat this form of heart disease by prescribing medication or by an electrical shock to the chest to return the beating back to normal.

Quitting Smoking

Once someone stops smoking, stroke risk will drop significantly within two years.[2] Within five years of quitting, the stroke risk may be the same as someone who's never smoked.[2] Doctors can share information about quitting and prescribe medicine to help. It's especially advisable for women over 30 who smoke and also take high-estrogen birth-control pills to quit smoking. This combination of factors makes a woman 22 times more likely to have a stroke than the average person.[15] However, most physicians no longer prescribe high-estrogen birth control pills to smokers.

Monitoring Alcohol Consumption

For most people, moderate drinking may help lower stroke stroke risk. "Moderate" drinking means limiting intake of alcohol to no more than two drinks per day (one drink = 1.5 oz. of hard liquor; OR 4 oz. of wine; OR 12 oz. of beer). If you don't drink, don't start.

Controlling Weight

Doctors can recommend a sensible weight-loss and exercise program for people who are at increased stroke risk because they are overweight. With their doctors, overweight patients should set reasonable weight-loss and exercise goals. A common goal is to aim for losing one pound a week and exercising three times a week for 30 minutes at a time. Losing excess weight can also help control other stroke risk factors, such as high blood pressure, high cholesterol, heart disease and/or diabetes.

For more information on controlling stroke risk factors and prevention please turn to NSA's Stroke Prevention Guidelines on page 34.

Antihypertensive Medication

When blood pressure can't be controlled through lifestyle modification, a patient's doctor may prescribe an antihypertensive medication. There are more than 50 prescription antihypertensive drugs on the market. In many patients, some antihypertensives may cause side effects such as dizziness or nausea. Doctors can work with patients to select the best antihypertensive for their medical profile and lifestyle. Various antihypertensive drugs work differently — some decrease the volume of plasma in the blood or slow the rate of blood flow through the body, while others relax the heart by affecting the passage of certain elements in the blood. Factors to consider in the selection of antihypertensive drugs include cost, convenience, side effects and interaction with other drugs.

Compliance is Critical

One of the biggest obstacles doctors encounter in high blood pressure treatment is getting patients to take their medications as directed. Medication for high blood pressure will only work if it's taken on a regular basis. It is important for patients to take their blood pressure medication as directed, even on days when they feel well.

- Fifty million Americans have elevated blood pressure or are taking antihypertensive medication, yet nearly 75 percent do not have their blood pressure adequately controlled.[4]
- The Systolic Hypertension in the Elderly Program (SHEP) demonstrated that treating high blood pressure can reduce stroke rates by 36 percent.[16] Even a moderate reduction in blood pressure can reduce stroke risk.[17, 18]
- The percentage of patients who are aware of their blood pressure rates and what can be done to treat the condition is increasing. Over half of the people who are aware of their blood pressure now take medication to treat it, but rates still need to improve.[19]

Controlling Heart Disease

Cholesterol Reducing Medication for Coronary Heart Disease

Many people can successfully control their cholesterol levels through diet and exercise, but some cannot. For these people medication may be prescribed by a doctor to lower cholesterol levels. These medications will only work if taken as directed on a regular basis.

Statins are a common class of drugs that may help reduce the size of the plaque that causes hardening and clogging of the arteries. New studies have also shown some statins are effective in reducing the risk of stroke or transient ischemic attack (TIA) in patients who have had a heart attack, even if they have average or only slightly elevated cholesterol levels.

Two cholesterol-reducing medications in the statin class have been approved by the U.S. Food and Drug Administration for the prevention of first stroke or TIA in patients who have had a heart attack or who have coronary heart disease. Other medications may be prescribed specifically to reduce high cholesterol.

Pravastatin

Pravastatin, brand name Pravachol®, is proven to prevent heart attacks in patients with or without a medical history of coronary heart disease. In patients with a personal history of heart attack and average cholesterol (less than 240), pravastatin is indicated to reduce the risk of stroke or TIA and recurrent heart attacks. It is also indicated to slow the progression of coronary atherosclerosis and reduce the risk of acute coronary events, including heart attacks in people with high cholesterol.

Side Effects

Pravastatin is generally well tolerated. The most common adverse events are rash, fatigue, headache and dizziness.

Contraindications

People who have allergies to any of its components, active liver disease or liver problems or patients who are pregnant, nursing or likely to become pregnant should talk to their doctors before taking Pravastin. Muscle pain or weakness in patients taking pravastatin may indicate a rare but serious side effect and should be reported to their doctor. Doctors may perform blood tests to check liver functions before and during treatment with pravastatin.

Simvastatin

Simvastatin, brand name Zocor®, is the only statin drug approved by the FDA to prevent heart attacks and reduce the risk of first stroke or TIA in patients with high cholesterol and coronary heart disease.

Side Effects

Simvastatin is generally well tolerated. The most common side effects include headache, abdominal pain and constipation.

Contraindications

Simvastatin should not be used by anyone who is allergic to any of its components, patients with liver disease or by women who are pregnant, nursing or likely to become pregnant. Muscle pain or weakness in patients taking simvastatin may indicate a rare but serious side effect and should be reported to their doctor. Doctors may perform blood tests before and periodically during treatment with simvastatin to check for liver problems.

Several other cholesterol lowering drugs are also available and may prove effective in certain individuals. Talking with a doctor is essential to find out which medications will work best.

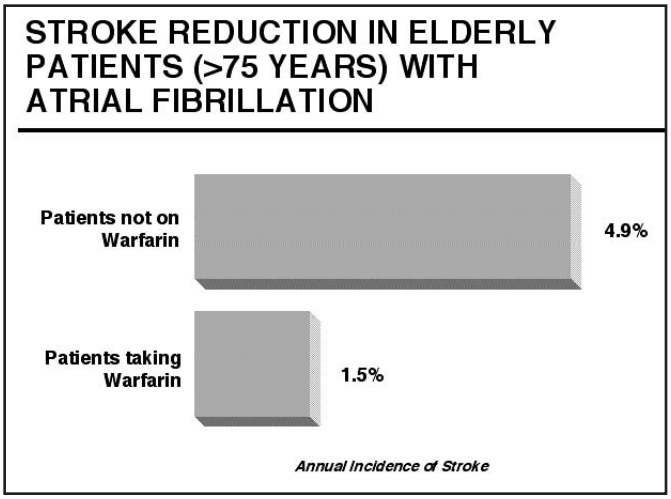
Clot Prevention Medication

Since most strokes are caused by clots, it makes sense to try to prevent a second stroke by preventing clots from forming. There are two primary classes of clot prevention drugs: anticoagulants and antiplatelet drugs.

Anticoagulants

Anticoagulants have proven beneficial in preventing recurrent clot-caused strokes because they prevent blood clots from forming or growing. Anticoagulants interfere with the production of certain blood components necessary for clot formation. In addition, they have been proven to prevent transient ischemic attacks (TIAs) and strokes in some patients.

Warfarin (Coumadin®)



Warfarin usually is used for long-term anti-clotting, particularly in patients with atrial fibrillation (AF). Coumadin is the brand name most people recognize for warfarin. Results from several studies concluded that patients with atrial fibrillation and other specific risk factors for stroke, such as age, previous TIA, hypertension or diabetes, reduced their overall stroke risk significantly by taking warfarin.[20] Only one-third as many strokes occurred in AF patients receiving warfarin as in patients who were not taking the drug.[20] For patients unable or unwilling to take warfarin, aspirin is an alternative although it is less effective. AF patients should be considered for therapy unless other health problems are present. Long-term anticoagulation does carry some risk of bleeding problems, but a body of research supports the conclusion that when carefully administered, the benefits outweigh the risks.

It is important for those taking the drug to maintain a consistent level of Vitamin K in their diets. They should be aware of food rich in vitamin K that could increase levels and counteract the drug. Foods high in vitamin K include all green leafy vegetables and certain vegetable oils. Warfarin interacts with numerous drugs, including prescription and over-the-counter medications. Speaking with a health care provider regarding all medications being taken is essential.

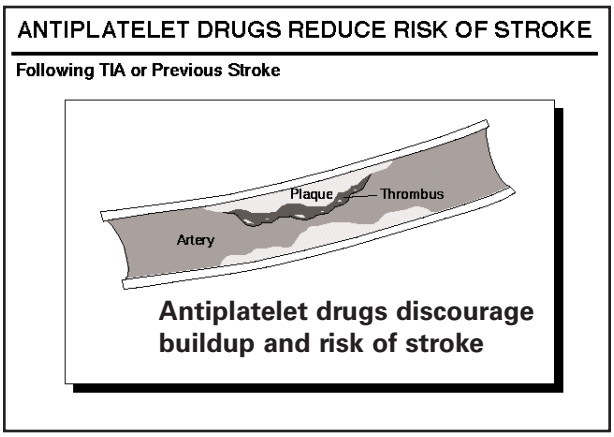
Side Effects

Patients on warfarin could experience hemorrhage from any tissue or organ and, less frequently, skin decay, gangrene and "purple toes syndrome."

Contraindications

Patients with any condition or personal circumstance that increases the risk of hemorrhage to a level greater than the benefits of anticoagulation should not take this drug.

Antiplatelet drugs



Antiplatelet drugs are prescribed to prevent blood clots from forming or growing. Antiplatelet agents attack the very beginning of the clot formation process by stopping an important enzyme necessary for platelets to generate and stick together to form clots.

Aspirin

Aspirin is viewed as the "gold standard" antiplatelet drug both because it's effective and inexpensive. Researchers have studied the preventive benefits of aspirin regimens ranging from 81 mg (one baby aspirin) to 1,300 mg (four adult aspirin). The optimal dose of aspirin is still unsettled, but most experts would agree that a dose of 325 mg per day is reasonable in most cases.

Side Effects

Users of aspirin may experience stomach pain (which can be reduced by eating before usage or using enteric-coated aspirin), heartburn, nausea, vomiting and gastrointestinal bleeding.

Contraindications

People allergic to aspirin should consult their physicians.

Extended-Release Dipyridamole with Aspirin (Aggrenox)®

The combination of aspirin and extended-release dipyridamole called Aggrenox® (aspirin 25 mg/extended-release dipyridamole 200 mg) is approved by the FDA. The combination was studied in the European Stroke Prevention Study 2. Aggrenox® reduced the risk of stroke after a first stroke or TIA by 37 percent compared to placebo. When both Aggrenox® and aspirin were compared to placebo, Aggrenox® was more effective than aspirin in its ability to reduce the risk of recurrent stroke.[26] There is no generic formulation of this compound.

Side Effects

Patients taking Aggrenox® may experience dizziness, abdominal distress, headache, skin rash, diarrhea, vomiting, flushing and pruritus.

Contraindications

Because of its aspirin content, Aggrenox® should not be taken by anyone who is allergic or sensitive to aspirin.

Clopidogrel (Plavix)®

Research has shown that the FDA-approved agent clopidogrel, brand name Plavix®, is more effective than aspirin at reducing the risk of heart attack, ischemic stroke and vascular death in patients who have suffered a recent heart attack, stroke or who have peripheral artery disease. In the *Clopidogrel vs. Aspirin in Patients at Risk for Ischemic Events* study, clopidogrel prevented 7.3 percent more secondary strokes than aspirin.[25]

Side Effects:

People taking clopidigrel may develop skin rash and diarrhea.

Contraindications:

Those with hypersensitivity to the drug substance or any component, active pathological bleeding such as peptic ulcers or intracranial hemorrhage should not take this medication.

Ticlopidine (Ticlid)®

Ticlopidine, brand name Ticlid®, is approved for patients who have already had a stroke or TIA and who are unable to take aspirin. The Ticlopidine/Aspirin Stroke Study looked at people who had experienced a stroke or TIA and found that ticlopidine produced a 21 percent relative risk reduction for recurrent stroke over aspirin at the end of three years.[22,23] Despite its effectiveness, aspirin is still a preferred therapy for qualified patients because of ticlopidine's side effects. Ticlid can cause neutropenia (a reduction of white blood cells). Because of this risk, ticlopidine use requires blood monitoring during the first three months of treatment.

In addition, ticlopidine is significantly more expensive than aspirin. However, one pharmaco-economic analysis concluded that ticlopidine stroke prevention therapy is as cost-effective as aspirin treatment over an individual's lifetime of care.[24]

Side Effects

Skin rash, diarrhea, intestinal discomfort, neutropenia (decreased white blood cell count), liver problems, jaundice, bleeding and bruising.

Contraindications

Presence of blood disorder, hemostatic or active bleeding disorder and liver impairments.

Carotid Endarterectomy

Carotid endarterectomy is the most common vascular surgery in the United States and the third most common surgery overall.[27] Today, the surgery is proving more successful than ever in preventing stroke, reducing risk by as much as 66 percent.[28] Blockages in the carotid arteries are the major contributor to the most common type of stroke.

Carotid Endarterectomy Q and A

Q. What is a carotid endarterectomy?

A. A carotid endarterectomy is a surgical procedure in which a doctor removes fatty deposits from one of the two main arteries in the neck supplying blood to the brain. Carotid artery problems become more common as people age. The disease process that causes the buildup of fat and other material on the artery walls is called atherosclerosis, popularly known as "hardening of the arteries." The fatty deposit is called plaque; the narrowing of the artery is called stenosis. The degree of stenosis is usually expressed as a percentage of the normal diameter of the artery opening.

Q. Why is the surgery performed?

A. Carotid endarterectomies are performed to prevent stroke. Two large clinical trials supported by the National Institute of Neurological Disorders and Stroke (NINDS) have identified specific individuals for whom the surgery is highly beneficial when performed by surgeons and in institutions that can match the standards set in those studies. The surgery has been found highly beneficial for persons who have already had a stroke or experienced the warning signs of a stroke and have a 70 percent to 99 percent blockage of the artery. In this group, surgery reduces the estimated two-year risk of stroke by more than 80 percent. In a second trial, the procedure has also been found highly beneficial for pesons who are symptom-free, but have a severe blockage of 60 percent to 99 percent. In this group, the surgery reduces the estimated 5-year risk of stroke by more than one-half.[29]

Q. How important is a blockage as a cause of stroke?

A. A blockage of a blood vessel is the most common cause of 750,000 new or recurrent strokes in the United States each year.

Q. How many carotid endarterectomies are performed each year?

A. Statistics available from the National Hospital Discharge Survey show there were about 130,000 carotid endarterectomies performed in the United States in 1996.[27] The procedure has a 40-year history. It was first described in the mid-1950s. Its use increased as a stroke prevention measure in the 1960s and 1970s and has continued to climb in numbers each year.

Q. How much does a carotid endarterectomy cost?

A. The total average cost for the diagnostic tests, surgical procedure, hospitalization and follow-up care is about $15,000.[30]

Q. How risky is the surgery?

A. The degree of risk varies with the hospital, the surgeon and the underlying disease conditions.

Q. How is carotid artery disease diagnosed?

A. In most cases, the disease can be detected during a normal checkup with a physician. Some of the tests a physician may use or order include:

- **History and physical exam:** A doctor will ask about stroke symptoms such as numbness or muscle weakness, speech or vision difficulties or light-headedness. Using a stethoscope, a doctor may hear a rushing sound, called a *bruit* (pronounced "brew-ee"), in the carotid artery. Unfortunately, some low-risk blockages can make a significant sound, while dangerous levels of disease some times fail to make a sound at all.

- **Doppler ultrasound imaging:** This is a painless, non-invasive test in which sound waves above the range of human hearing are sent into the neck. Echoes bounce off the moving blood and the tissue in the artery and can be formed into an image. Ultrasound is fast, risk-free, relatively inexpensive and painless. In carefully calibrated ultrasound laboratories, ultrasound studies can be up to 95 percent accurate.

- **Computed tomography (CT):** This test produces a series of X-rays of the head and brain. It cannot detect carotid artery disease, but may be ordered by a doctor to investigate other possible causes of symptoms. The test is also called a CAT scan, for computer assisted tomography.

- **Arteriography and Digital Subtraction Angiography (DSA):** Arteriography is an X-ray of the carotid artery taken when a special dye is injected into another artery in the leg or arm. A burning sensation may be felt when the dye is injected. DSA is also an X-ray study of the carotid artery. It is similar to arteriography except that less dye is used. These invasive procedures are more expensive and carry their own small risk of causing a stroke.

- **Magnetic Resonance Angiography (MRA):** This is an imaging technique that is more accurate than ultrasound, yet avoids the risks associated with X-rays and dye injection. An MRA is a type of magnetic resonance image that uses special software to create an image of the arteries in the brain. A magnetic resonance image uses harmless, but powerful magnetic fields to create a highly detailed image of the body's tissues.

Frequently these procedures are carried out in a stepwise fashion: from a doctor's evaluation of symptoms to ultrasound, with arteriography, DSA or MRA reserved for difficult diagnoses.

Angioplasty and stenting

The procedure is currently in the investigational phase. Angioplasty and stenting are currently being used together to prevent a blockage in the artery from reoccurring. Angioplasty opens the blocked artery or blood vessel through the use of catheters. After the artery has been opened, a stent or small, stainless steel tube is inserted into the artery to prevent further blockages.

Complications such as bleeding, heart attack and stroke seem to occur more frequently in stenting procedures than in carotid endarterectomies, so the procedure is currently not the recommended treatment for carotid artery disease.

Stroke Prevention Guidelines

In 1998, National Stroke Association's (NSA) Prevention Advisory Board released its Stroke Prevention Guidelines. These guidelines were the first-ever national expert consensus set of recommendations on what the public can do to prevent stroke. In 1999, NSA released more detailed medical guidelines for professionals.

The Prevention Advisory Board is comprised of the nation's leading experts on stroke prevention.

STROKE IS PREVENTABLE

National Stroke Association
Stroke Prevention Guidelines

1. **Know your blood pressure. Have it checked at least annually. If it is elevated, work with your doctor to control it.**
2. **Find out if you have atrial fibrillation (also called AF). If you have AF work with your doctor to manage it.**
3. **If you smoke, stop.**
4. **If you drink alcohol, do so only in moderation.**
5. **Know your cholesterol number. If it is high, work with your doctor to control it.**
6. **If you are diabetic, follow your doctor's recommendations carefully to control your diabetes.**
7. **Include exercise in the activities you enjoy in your daily routine.**
8. **Enjoy a lower sodium (salt), lower fat diet.**
9. **Ask your doctor if you have circulation problems which increase your risk for stroke. If so, work with your doctor to control them.**
10. **If you have any stroke symptoms, seek immediate medical attention.**

Stroke Prevention Guidelines for the Public

1. **Know your blood pressure. Have it checked at least annually. If it is elevated, work with your doctor to keep it under control.**
   - High blood pressure (hypertension) is a leading cause of stroke.
   - Have your blood pressure checked at least once each year – more often if you have a history of high blood pressure.
   - If the higher number (your systolic blood pressure) is consistently above 130 or if the lower number (your diastolic blood pressure) is consistently over 85, consult your doctor.
   - If your doctor confirms that you have high blood pressure, he/she may recommend changes in your diet, regular exercise, and possibly medication.

2. **Find out if you have atrial fibrillation (AF). If you have AF, work with your doctor to manage it.**
   - Atrial fibrillation (AF) can cause blood to collect in the chambers of your heart. This blood can form clots and cause a stroke.
   - Your doctor can diagnose AF by carefully checking your pulse. AF can be confirmed with an ECG (electrocardiogram).
   - If you have AF, your doctor may choose to lower your risk for stroke by prescribing medications such as warfarin or aspirin.

3. **If you smoke, stop.**
   - Smoking doubles the risk for stroke.
   - If you stop smoking today, your risk for stroke will immediately begin to drop.
   - Within five years, your stroke risk may be the same as that of a non-smoker.

4. **If you drink alcohol, do so in moderation.**
   - Drinking up to two glasses of wine, or the alcohol equivalent, each day may actually lower your risk for stroke (*provided that there is no other medical reason you should avoid alcohol).*
   - Heavy drinking increases your risk for stroke.
   - Remember that alcohol is a drug — it can interact with other drugs you are taking, and alcohol is harmful if taken in large doses.

5. **Know your cholesterol number. If it is high, work with your doctor to control it.**
   - Lowering your cholesterol may reduce your risk for stroke. Having high cholesterol can indirectly increase stroke risk by putting you at greater risk of heart disease – another important stroke risk factor.
   - Some cholesterol-lowering medications have been shown to lower the risk of stroke in some high-risk individuals.
   - High cholesterol can be controlled in many individuals with diet and exercise; some individuals may require medication.
   - Recent studies show that some individuals with normal cholesterol may lower their risk for stroke by taking specific medications for cholesterol.

6. **If you are diabetic, follow your doctor's recommendations carefully to control your diabetes.**
   - Having diabetes puts you at an increased risk for stroke.
   - Often, diabetes may be controlled through careful attention to what you eat.
   - Your doctor can prescribe a nutrition program, lifestyle changes and medicine that can help control your diabetes.

7. **Include exercise in the activities you enjoy in your daily routine.**
   - A brisk walk or other activity for as little as 30 minutes a day can improve your health in many ways, and may reduce your risk for stroke.
   - Try walking with a friend; this will make it more likely that you'll make it a habit.
   - If you don't enjoy walking, choose another exercise activity that suits your lifestyle; bicycle, golf, swim, dance, play tennis or take an aerobics class.

8. **Enjoy a lower sodium (salt), lower fat diet.**
   - By cutting down on sodium and fat in your diet, you may be able to lower your blood pressure and, most importantly, lower your risk for stroke.

9. **Ask your doctor if you have circulation problems which increase your risk for stroke. If so, work with your doctor to control them.**
   - Fatty deposits - caused by atherosclerosis or other diseases - can block the arteries which carry blood from your heart to your brain. This kind of blockage, if left untreated, can cause stroke.
   - You can be tested for this problem by your doctor.
   - If you have blood problems such as sickle cell disease, severe anemia or other diseases, work with your doctor to manage these problems. Left untreated, these can cause stroke.
   - Circulation problems can usually be treated with medications.
   - Occasionally surgery is necessary to remove the blockage.

10. **If you see or have any stroke symptoms, seek immediate medical attention.**
    - Sudden numbness or weakness of face, arm or leg— especially on one side of the body
    - Sudden trouble seeing in one or both eyes
    - Sudden confusion, trouble speaking or understanding
    - Sudden trouble walking, dizziness, loss of balance or coordination
    - Sudden severe headache with no known cause

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Evolution and Revolution

Since the beginning of the recorded history of the condition, stroke has been viewed as not preventable and untreatable. It was deemed a "stroke of fate" or a "stroke of God's hands." Added to this fatalism was the subtle, but important factor of "ageism" – wrongly believing that stroke happens only to the elderly and is therefore not of concern.

Even today, these misconceptions are firmly entrenched, both among the public and among health care providers. Believing that stroke is untreatable or that their symptoms are not serious enough, the public often fails to seek medical attention quickly enough for effective treatment.

Time: Traditional vs Emerging Views

Is Time Therapy or Enemy

Traditional View

> Patient - Wait and see if symptoms disappear

> Pre-hospital - Stroke is low-priority for transport

> Hospital - Give it time to resolve

New View

> Patient - Stroke is "Brain Attack," Call 911

> Pre-hospital - High priority - reduce time from call to hospital

> Hospital - Emergency code - protocols - clinical pathways

One study showed that among patients who were interviewed within 48 hours of having a stroke, only 36 percent thought they might be having a stroke before they arrived at the hospital. Those patients who could name the signs and symptoms of stroke were twice as likely to know they were having a stroke.[1] In addition, some healthcare providers may believe that stroke is untreatable, and take an attitude of "watchful waiting" instead of treating stroke as a medical emergency. In one study, physicians who received focused educational sessions on cranial CT scan interpretation improved their skills and thus improved patient treatment and diagnosis times.[2]

Reasons Patients Don't Seek Immediate Treatment[3]

> Don't recognize symptoms

> Think symptoms will disappear

> Think nothing can be done - no emergency

> Worried about cost

> Don't want fears confirmed - denial

> Fear of hospitals

Our notions about stroke and its treatment were truly revolutionized during the 1990's, often called the "Decade of the Brain." The new stroke interventionalists (neurologists, neuroradiologists, emergency medicine physicians and their colleagues) are even more dedicated to stroke treatment.

Classes of Acute Stroke Treatment

Thrombolytics

Thrombolytic (fibrinolytic) drugs help reestablish blood flow to the brain by dissolving the clots, which are blocking the flow. In June, 1996, the "clot-buster" Activase (Alteplase recombinant) became the first acute ischemic stroke treatment to be approved by the Federal Food and Drug Administration (FDA). To be effective, thrombolytic therapy should be given as quickly as possible.

First FDA-Approved Acute Stroke Treatment

Tissue plasminogen activator (t-PA) is an enzyme found naturally in the body that converts, or activates, plasminogen into another enzyme to dissolve a blood clot. T-PA may also be used in an IV by doctors to speed up the dissolving of a clot. The first FDA-approved acute treatment for ischemic stroke is a recombinant, or genetically engineered, form of tissue plasminogen activator (rt-PA). Known by brand name Activase®, this treatment was approved for marketing in June, 1996. The results of a five-year trial, conducted by the National Institute of Neurological Disorders and Stroke (NINDS) found that carefully selected stroke patients who received Activase® within three hours of the beginning of stroke symptoms were at least 33 percent more likely than patients given a placebo to recover from their stroke with little or no disability after three months.[4] The most common complication associated with Activase® is brain hemorrhage. However, studies have shown that t-PA does not increase the death rate of stroke patients when compared with placebo.

Neuroprotectives

During stroke, the death of brain cells in the immediate area begins a cascading effect of brain cell death in the area surrounding the stroke. Neuroprotective drugs work to minimize the effects of this peripheral damage. While there are currently no neuroprotective agents available commercially, several different types of these drugs are in clinical trials for acute stroke treatment. Because of their complementary functions of clot-busting and brain-protection, future acute treatment of ischemic stroke will most likely involve the combination of thrombolytic and neuroprotective therapies. Like thrombolytics, most neuroprotectives need to be administered quickly after a stroke to be effective.

Other Treatments for Acute Ischemic Stroke

Oxygenated Fluorocarbon Nutrient Emulsion (OFNE) Therapy

Oxygenated Fluorocarbon Nutrient Emulsion (OFNE) has been studied to treat an ischemic stroke by delivering oxygen and nutrients to the brain through the cerebral spinal fluid. The treatment begins by combining several nutrients to make an oxygenated fluorocarbon nutrient emulsion ("OFNE"). In use, OFNE is charged with oxygen and pumped into the cerebral spinal fluid (CSF) spaces of the brain. There, OFNE circulates throughout the brain before removal at the base of the spine.

Neuroperfusion

Neuroperfusion is an experimental procedure in which oxygen-rich blood is rerouted through the brain as a way to prevent the damage an ischemic stroke can cause.

The procedure literally reverses the "plumbing" of the circulatory system near the stroke-affected area, using the veins — which are free and clear — to deliver oxygenated blood to compromised brain tissue. Normally the arteries would carry this blood to the brain, but after an ischemic stroke, a blockage prevents this from happening.

During the neuroperfusion procedure, oxygen-rich blood is drawn from an artery in the leg and injected into the veins in the back of the head. It then circulates into the affected tissue while partially inflated balloons keep the blood from flowing out. Doctors begin the procedure up to seven hours after the onset of stroke symptoms and can keep blood circulating for several hours. Early research had found that during this time, the clot usually dissolves itself or is washed away by the pressure of reverse-flowing blood.

Blood Substitutes

In response to blood shortages and safety concerns over transfusions, researchers began looking for a safe and effective alternative to blood. These "blood substitutes" were primarily intended for emergency clinical situations where blood may not be readily available. However, during their development, other potentially therapeutic applications have been recognized.

One such application is the treatment of ischemic diseases like stroke and heart attack. Some solutions containing hemoglobin — an oxygen-delivering protein within a red blood cell — may provide nutrients to brain tissue blocked off by a stroke. In preclinical studies, this effect helped hemoglobin deliver oxygen to vital organs despite severe blood loss or disease.

Several stroke clinical trials are currently underway.

For more information on current trials visit:
www.stroke.org
www.acurian.com
www.clinicaltrials.gov

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Recovery and Rehabilitation

More than four million people in the United States have survived a stroke and are living with the after-effects. Stroke also impacts the lives of millions of family members and caregivers of survivors.

The word "stroke" indicates that no one is ever prepared for this sudden, often catastrophic event. Stroke survivors and their families can find workable solutions to most difficult situations by approaching problems with patience, ingenuity, perseverance and creativity.

Early Recovery

There's still so much we don't know about how the brain compensates for the damage caused by stroke. However, in the past 10 years, stroke rehabilitation has come a long way. We have learned that some brain cells may be only temporarily damaged, not killed, and may resume functioning. In some cases, the brain can reorganize its own functioning, when a region of the brain "takes over" for a region damaged by the stroke. Stroke survivors sometimes experience remarkable and unanticipated recoveries that cannot be explained. In general though, recovery guidelines show[2]:

- 31 percent of stroke survivors need help caring for themselves
- 20 percent need help walking
- 16 percent are institutionalized
- 71 percent are vocationally impaired after 7 years

Rehabilitation

Rehabilitation actually starts in the hospital as soon as possible after the stroke. In the case of stroke survivors who are stable, rehabilitation may begin within two days after the stroke has occurred, and should be continued as necessary after release from the hospital.

Depending on the severity of the stroke, rehabilitation options include:

- The rehabilitation unit in the hospital
- A sub-acute care unit in a hospital or long-term care facility
- A rehabilitation hospital
- Home with outpatient therapy
- Stroke day program
- A long-term care facility that provides therapy and skilled nursing care
- Home therapy

The goal in rehabilitation is to improve function so that the stroke survivor can become as independent as possible. This should be accomplished in a way that preserves dignity and motivates the survivor to relearn basic skills that the stroke may have taken away - skills like eating, dressing, walking or even speaking.

Rehabilitation Health Care Team

A rehabilitation health care team for a stroke survivor includes several professional specialties:

Neurologists are physicians skilled in the diagnosis and treatment of diseases of the nervous system.

Physiatrists are specialists in physical medicine and rehabilitation who have been trained to assess the disability, monitor a stroke survivor's health and treat the medical complications of the disability.

Rehabilitation nurses work with the other rehabilitation professionals to personalize a care plan. He or she assists the survivor with activities of daily living and helps make rehabilitation services part of a daily routine. The rehab nurse also educates the survivor and family members about the disabilities relating to stroke, medication and treatment.

Physical therapy (PT) helps restore physical functioning and skills like walking and range of movement. Major impairments which PT works on include partial or one-sided paralysis, faulty balance and foot drop.

Occupational therapy (OT) involves relearning the skills needed for everyday living such as eating, toileting, dressing and taking care of oneself.

Speech language pathology is another major rehabilitative therapy. Some stroke survivors are left with aphasia, an impairment of language and speaking skills in which the stroke survivor can think as well as before the stroke, but is unable to get the right words out or is unable to process words coming in. Aphasia is usually caused by a stroke on the left side of the brain. Speech language pathology can teach the aphasic stroke survivor and his or her family members methods for coping with this frustrating impairment. Speech language pathologists also work to help the stroke survivor cope with memory loss and other "thought" problems caused by the stroke.

Recreation therapy reintroduces leisure and social activities back into a survivor's life. Some activities which might be included in a therapeutic recreation program are swimming; going to museums, plays and libraries; or taking music and art lessons. An important goal of the therapy is to restore a survivor's socialization skills for reentry into the community.

Psychologists, social workers/case managers also aid patients with emotional and adjustment issues by providing counseling and support services. Social workers/case managers may help families and caregivers determine the best possible solutions to rehabilitation and recovery needs.

Life at Home for Stroke Survivors and Family

After a stroke, both the stroke survivor and the family members may be apprehensive about being on their own at home. Among the common concerns are fear:

- that a stroke might happen again
- that the stroke survivor may be unable to accept the disabilities
- that the survivor might be placed in a nursing home
- that the caregiver may not be prepared to face the responsibility of caring for the stroke survivor
- that friends and family will abandon them

Behavior

As survivors learn to adapt to life after stroke, caregivers may need to adjust the living environment to the survivor's behavior. For example, the confused, cautious stroke survivor needs an ordered environment. The stroke survivor with poor judgment must be guided when making important decisions. The apathetic stroke survivor, on the other hand, should not live in a world so quiet and simple that there is little to react to. The caregiver needs to be aware of the reasons for the stroke survivor's behavior, without overlooking the fact that he or she may also be depressed.

Depression

Many people experience some form of depression after stroke. It can be overwhelming, affecting the spirit and confidence of everyone involved. A depressed person may refuse or neglect to take medications, may not be motivated to perform exercises which will improve mobility or may be irritable with others. The stroke survivor's depression may dampen the family's enthusiasm for helping with recovery or drive away others who want to help. This deprives the stroke survivor of the social contacts that could help dispel depression, creating a vicious cycle.

It is possible that as time goes by and a stroke survivor's deficits improve, the depression may lift by itself. Family can help by trying to stimulate interest in other people, encouraging leisure activities and providing opportunities to participate in spiritual activities. Chronic depression may require medical attention and can be treated with individual counseling, group therapy or antidepressant drugs.

Emotional Lability

Sudden laughing or crying for no apparent reason and difficulty controlling emotional responses, known as emotional lability, affects many stroke survivors. There may be no happiness or sadness involved, and the emotional display will end as quickly as it started.

Neglect

Some stroke survivors neglect the side of their world opposite to the side of their brain that was injured by the stroke. Those with damage on the right side of the brain may not perceive what is on their left side. This condition is known as left-side neglect. For example, the stroke survivor with left-sided neglect may ignore the left side of the face when washing or not eat food on the left side of the plate. If the stroke survivor's head is moved to the left, neglected objects may become apparent.

Memory Loss

Some changes in behavior, such as memory loss, can be so subtle that family members may not notice them initially. A stroke survivor may be anxious and cautious, needing a reminder to finish a sentence or to know what to do next. Some stroke survivors have difficulty with numbers and calculating. There are several different types of memory loss after stroke. The most common is vascular dementia.

What is Vascular Dementia?

Vascular dementia (VaD) is a decline in intellectual abilities as a result of a stroke. It occurs when brain tissue is damaged because of reduced blood flow to the brain, most commonly by a stroke or series of strokes. The brain cells, in effect, have difficulty working together to process information. This can lead to memory loss, confusion, and decreased attention span, in addition to problems with activities of daily living.

It is estimated that nearly a fifth of people who suffer a stroke will develop problems involving their mental abilities.

Approximately 10 to 20 percent of Americans over age 65 experiencing dementia have VaD, making it second only to Alzheimer's disease as a leading cause of dementia.

The occurrence of VaD increases with age, and the number of Americans age 65 and older is expected to increase to nearly 70 million by 2030.

Some of the risk factors for VaD are the same as for stroke, including high blood pressure, history of previous stroke, diabetes, heart disease, and high cholesterol levels.

Symptoms of Vascular Dementia

- Memory loss
- Confusion
- Mood swings and personality changes
- Language problems
- Difficulty paying attention or following a conversation
- Impaired motor skills
- Difficulty planning and organizing tasks
- Visual orientation problems
- Difficulty with calculations, making decisions, solving problems
- Depression-like behavior

Patients with VaD often deteriorate in a step-wise manner, with symptoms becoming greater with each new stroke. Sometimes, however, dementia can come on abruptly as the result of a single stroke, depending on the location and size of damaged brain area.

In some instances, the onset of VaD is so gradual that healthcare providers have difficulty distinguishing it from Alzheimer's disease. The dementia in these cases is likely the result of chronic inadequate blood circulation in the brain that can cause small, silent strokes, or TIAs.

Patients with VaD may become more dependent upon family members or caregivers for assistance with activities of daily living due to physical and behavioral changes.

Diagnosing Vascular Dementia

Your healthcare provider should conduct a complete medical and patient history evaluation in order to determine the presence of VaD. Diagnostic tests may be used to exclude other possible causes of cognitive decline. Clinical tools are available to assist healthcare professionals in diagnosing VaD, including brain imaging techniques (CT or MRI) and tests of cognitive functioning.

Treating Vascular Dementia

There are currently no therapies or drugs approved by the U.S. Food and Drug Administration (FDA) available for the treatment of VaD. Recently, an existing drug was submitted to the FDA for review as a potential treatment for VaD.

The current treatment strategies focus on reducing the risk of additional strokes, or prevention of stroke.

Other clinical trials are currently underway to test drugs that may treat patients with VaD.

Any type of memory loss, including vascular dementia, needs to be evaluated by a physician.

Communication Problems

If a stroke causes damage to the language center in the brain, which is usually found on the left side of the brain, there will be language difficulties. Some stroke survivors are unable to understand or speak at all. Others do not make sense when they speak. Some can no longer read or write, and many have difficulty pronouncing words. Communication problems are among the most frightening after-effects of stroke for both the survivor and the family, often requiring professional help. Persons with right brain injury often have difficulty with attention, social etiquette, and non-verbal communication such as tone of voice and facial expression.

Daily Living Skills

Stroke survivors will find that completing simple tasks around the house which they took for granted before the stroke are now extremely difficult or impossible. Many adaptive devices and techniques have been designed especially for stroke survivors to help them retain their independence and to function safely and easily. Homes usually can be modified so that narrow doorways, stairs and bathtubs do not interfere with the stroke survivors' abilities to care for their personal needs.

Helpful bathroom devices include grab bars, a raised toilet seat, a tub bench, a hand-held shower head, no-slip pads, a long-handled brush, a washing mitt with pockets for soap, soap-on-a-rope, an electric toothbrush and an electric razor.

There are many small electric appliances and kitchen modifications which also make it possible for the stroke survivor to participate in meal preparation.

Dressing and Grooming

Dressing oneself is a basic form of independence. The added value of being neatly and attractively dressed enhances a stroke survivor's self-image. There are many ways to eliminate the difficulties encountered in getting dressed. Stroke survivors should avoid tight-fitting sleeves, armholes, pant legs and waistlines; as well as clothes which must be put on over the head. Clothes should fasten in front. Velcro fasteners should replace buttons, zippers and shoe laces. Devices which can aid in dressing and grooming include a mirror which hangs around the neck, a long-handled shoe horn and a device to help pull on stockings.

Diet, Nutrition and Eating

A low-salt, low-fat, low-cholesterol diet can help prevent a recurrent stroke and maintain wellness. People with high blood pressure should limit the amount of salt they eat. Those with high cholesterol or hardening of the arteries should avoid foods containing high levels of saturated fats (i.e., animal fats). People with diabetes need to follow their doctor's advice on diet. These diet controls can enhance the benefits of the drugs which may have been prescribed for control of a specific condition.

Weight control is also important. Inactive people can easily become overweight from eating more than a sedentary lifestyle requires. Obesity can also make it difficult for someone with a stroke-related disability to move around and exercise.

Some stroke survivors may have a reduced appetite. Ill-fitting dentures or a reduced sense of taste or smell can make food unappealing. The stroke survivor who lives alone might even skip meals because of the effort involved in buying groceries and preparing food. Soft foods and foods with stronger flavors may tempt stroke survivors who are not eating enough. Nutrition programs, such as Meals on Wheels, or hot lunches offered through community centers have been established to serve the elderly and the chronically ill.

Special utensils can help people with physically-impaired arms and hands at the table. These include flatware with built-up handles which are easier to grasp, rocker knives for cutting food with one hand and attachable rings which keep food from being pushed off the plate accidentally.

Stroke survivors who have trouble swallowing need to be observed while eating so that they do not choke on their food. The same is true of those with memory loss who may forget to chew or to swallow. Tougher foods should be cut into small pieces.

Skin Care

Decubitus ulcers (sometimes called bed sores) can be a serious problem for stroke survivors who spend a good deal of time in bed or who use a wheelchair. The sores usually appear on the buttocks, heels, back of head and lateral side of the ankle.

To prevent bed sores, caregivers should make sure the stroke survivor does not sit or lie in the same position for long periods of time. Pillows should be used to support the impaired arm or leg. The feet can hang over the end of the mattress so that the heels don't rest on the sheet, or pillows can be put under the knees to prop them so that the

soles of the feet rest flat on the bed. Sometimes, a piece of sheepskin placed under weight bearing areas such as elbows, buttocks or heels can be helpful. Special mattresses or cushions also reduce pressure and help prevent decubitus ulcers.

Sexuality

The quality of a couple's sexual relationship following a stroke differs from couple to couple. Most couples do find that their sexual relationship has changed, but not all find this to be a problem. The closeness that a couple shares before a stroke is the best indicator of how their relationship will evolve after the stroke. It is important to remember that sexual satisfaction, both giving and receiving, can be accomplished in many ways. Whatever is comfortable and acceptable between partners is normal sexual activity.

Pain

A stroke survivor may suffer pain for many reasons. The weight of a paralyzed arm can cause pain in the shoulder. Improperly-fitted braces, slings or special shoes can cause discomfort. Often the source of pain can be traced to nerve damage, bed sores or an immobilized joint. Lying or sitting in one position too long causes the body and joints to stiffen and ache.

Spasticity After Stroke

Spasticity is an uncontrollable muscle tightness in an arm or leg that can cause pain and affect movement. The involuntary muscle contraction of spasticity is a common physical response to the brain injury caused by stroke. If the brain injury improves and voluntary movement returns, spasticity may diminish, restoring the usefulness of the limb. However, with stroke the damage is often permanent, so the spasticity must be treated independently. Spasticity usually is accompanied by weakness.

In a stroke survivor with spasticity, the reflex in the muscle does not obey the nervous system's order to relax and remains contracted. The brain injury from the stroke causes the reflex arc to lose control of the nervous system, similar to a parent that has lost control over a hyperexcitable child running wildly around a room. In a healthy brain, the reflex tells the muscles to relax and be still until told to contract.

Following stroke, spasticity is most common in the arm. It can cause a characteristic posture of a tight fist, bent elbow and arm pressed against the chest. This posture can seriously interfere with a stroke survivor's ability to perform daily activities such as dressing. Spasticity in the leg usually causes a stiff knee and pointed foot.

What are the Symptoms or Effects?

- Stiffness in the arms, fingers or legs
- Painful muscle spasms
- A series of involuntary rhythmic contractions and relaxations in a muscle or group of muscles that lead to uncontrollable movement or jerking, called clonus
- Increased muscle "tone"
- Abnormal posture
- Hyperexcitable reflexes

What Treatments are Available?

Treatment for spasticity is often progressive, starting from the lowest level of risk and side effects; only moving on to other options if treatment is ineffective and quality of life is significantly decreased. It's important for patients to discuss appropriate treatments for their individual cases with their physicians.

Stretching and Basic Care

A muscle stretching program performed at least one or twice daily by moving the affected limb through a full range of motion is considered basic management for spasticity. Regular stretching can prevent muscle shortening and reduce muscle spasticity for hours. Weight bearing exercises may also be beneficial in helping reduce spasticity.

Temporary Strategies

If stretching is not sufficient, casts and splints may be helpful in improving range of motion in spastic limbs. Other short-term techniques include applying cold compresses or local anesthesia to reduce spastic tone.

Oral Medication

Because of the wide range of problems caused by spasticity, it's doubtful that any one medication will help all effects of spasticity. In addition, all drugs used in the treatment of spasticity have the potential for side effects which should be weighed against their benefit.

Baclofen (Lioresal®) decreases muscle spasticity by inhibiting the stretch reflex, reducing spasms and increasing range of motion. It may also improve bladder control in selected patients. Side effects may include hallucinations, confusion, sedation, loss of muscle tone, poor muscular coordination and weakness in non–affected muscles.

Dantrolene sodium (Dantrium®) weakens spastic muscles and has little effect on normal muscles. Dantrolene may cause drowsiness, depression, nausea, vomiting, dizziness, diarrhea and liver malfunctioning.

Tizanidine hydrochloride (Zanaflex®) is a recently approved treatment for spasticity. Clinical trials have shown it to be equal to baclofen in reducing spasticity, but better tolerated. In addition, studies have demonstrated that Zanaflex, unlike all other oral spasticity medications, does not cause muscle weakness. Side effects include low blood pressure, sleepiness and dry mouth.

Diazepam (Valium®) helps control spasticity by relaxing the muscle. It is not used as frequently as other spasticity medications due to significant side effects including reduced mental sharpness, dependency and fatigue. It should only be used in select circumstances and with close monitoring of its effects.

Nerve Block Injections

Botulinum toxin (Botox®) is injected into the affected muscles to relax their spasticity by blocking the chemical impulses that cause muscles to contract. While oral medication affects multiple muscle groups in the body, Botox injections target only the specific muscles which are injected. A single injection can relax affected muscles for three to six months before the effects wear off. Side effects include soreness or swelling at the injection site, fatigue, excess muscle weakness and possible antibody formation. Botulinum toxin is most effective for managing spasticity in specific limbs or muscle groups.

Phenol is a type of alcohol which chemically blocks nerves in the affected muscles to reduce the spasticity. Neither block is suitable for patients with full-body spasticity because the treatment is technologically difficult. Phenol injections may cause pain during and after injection.

Spinal Medication

Intrathecal Baclofen (ITB) therapy delivers a liquid form of baclofen directly into the spinal fluid via a small pump that is surgically placed under the skin. Since the medication does not circulate throughout the body, only small doses are required to be effective, reducing the side effects common with oral baclofen. ITB Therapy has been shown to be effective in people with severe spasticity, including some who have not had good results with oral medications. The most common ITB Therapy drug side effects include loose muscles, drowsiness, nausea/vomiting, headache and dizziness.

Orthopedic Surgery

Surgery on specific affected muscles can improve isolated tasks in patients with severe spasticity. One of the most dramatic surgical procedures to improve the ability to walk is the split anterior tibial transfer (SPLATT). In a SPLATT operation, the surgeon splits a tendon that makes the foot turn inward and moves half of the tendon to the outside of the foot where it can help straighten and balance the foot as a walking surface. Surgery to cut and transfer tendons is also performed on other problematic muscles.

Neurosurgery

Neurosurgery is reserved as a last resort when other methods, such as nerve blocks, fail. Nerves can be surgically cut to more permanently disrupt nerve function. In a drastic surgery called rhizotomy, nerves are severed as they leave or enter the spinal cord, interrupting the spinal reflex arc and ending spasticity permanently.

Treatment of spasticity in stroke survivors should be customized for the patient taking into careful consideration the extent of the problems, individual symptoms and the patient's personal lifestyle goals. A combination of physical and occupational therapy, home exercise, medications and injections may be used to achieve the best function possible.

References

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2. American Heart Association. 1999 Heart and Stroke Statistical Update. Dallas, Texas: American Heart Association. 1999.

Additional information from Rao P, Rives M. *A Consumer Guide for People with Stroke: Choosing a Rehabilitation Program.* NRH Research Center, Washington, DC. 1997.

Additional Stroke Rehabilitation Resources

American Physical Therapy Association
1111 North Fairfax St
Alexandria, VA 22314
(800) 999-2782
www.apta.org

American Speech Language Hearing Association
10801 Rockville Pike
Rockville, MD 20852
(800) 638-8255
www.asha.org

National Aphasia Association
156 5th Ave #707
New York, NY 10010
(800) 922-4622
www.aphasia.org

National Family Caregivers Association
10605 Concord St. #501
Kensington, MD 20895-3109
(800) 896-3650
www.nfca.org

American Academy of Physical Medicine and Rehabilitation
One IBM Plaza #2500
Chicago, IL 60611-3604
(312) 464-9700
www.aapmr.org

Easter Seal Society
230 W. Monroe #1800
Chicago, IL 60606
(800) 221-6827
www.easter-seals.org

American Occupational Therapy Association
4720 Montgomery Lane
Bethesda, MD 20824-1220
(301) 652-2682
www.aota.org

Speaking the Language of Stroke

Activities of daily living (ADL): Basic daily living activities such as eating, grooming, toileting and dressing.

Alexia: Inability to understand written language.

Agraphia: Impairment or loss of the ability to write.

Ambulation: The act of walking.

Aneurysm: A permanent abnormal balloon-like bulging of an artery's wall. The bursting of an aneurysm in a brain artery or blood vessel causes a hemorrhagic stroke.

Angiography: A method of visualizing blood vessels by introducing a radiographic solution.

Anticoagulant agents: Drugs used in stroke prevention therapy to prevent blood clots from forming or growing. Anticoagulants interfere with the production of certain blood components necessary for clot formation.

Antihypertensive agents: Drugs used in stroke prevention therapy to reduce high blood pressure. Various antihypertensives work in different ways — some decrease the volume of plasma in the blood or slow the rate of blood flow through your body, while others relax the heart by affecting the passage of certain elements in the blood.

Antiplatelet agents: Drugs used in stroke prevention therapy to prevent blood clots from forming or growing. Antiplatelet agents attack the very beginning of the clot formation process by inhibiting an important enzyme necessary for platelet adhesion and activation.

Aphasia: A general term for communication problems, which may include the loss or reduction of the ability to speak, read, write or understand, due to dysfunction of brain centers.

Apoplexy: Latin word for stroke, derived from the Greek word plesso. Apoplexy was defined as "a stroke of God's hands."

Apraxia: A disorder of learned movement unexplained by deficits in strength, coordination, sensation or comprehension.

Arrhythmia: An irregular or unpredictable heart beat.

Arteriovenous malformation: (AVM) A congenital condition in which a group of arteries and veins are connected abnormally creating a tangle of distorted blood vessels of varying sizes. AVMs are usually associated with subarachnoid hemorrhages.

Atherosclerosis:	A hardening or build up of cholesterol plaque and other fatty deposits in the arteries.
Aspiration:	The act of inhaling solid or liquid materials into the lungs.
Ataxia:	A disorder in which muscles fail to move in a coordinated fashion.
Atrial fibrillation (AF):	A heart disease in which the upper left chamber of the heart beats out of rhythm with the other three chambers. Atrial fibrillation increases a person's stroke risk by six times. AF is generally treatable with medication.
Barthel Index:	Most commonly used scale that measures the ability of a patient to perform the activities of daily living, such as bathing and dressing.
Brain attack:	A term that more accurately describes the effect and action of stroke on the brain.
Brain stem:	The stem-like part of the brain that connects the brain's right and left hemispheres with the spinal cord. Responsible for non-thinking activities such as breathing, blood pressure and coordination of eye movements.
Brain stem stroke:	A stroke that strikes the brain stem, which controls involuntary life-support functions such as breathing, blood pressure and heart beat. Stroke in the brain stem can be particularly devastating.
Broca's Aphasia:	A type of aphasia in which the patient has difficulty expressing himself/herself even though understanding of written and spoken language is intact. Also known as motor, confluent, or expressive aphasia.
Bruit:	A distinctive "rushing" sound heard in the carotid arteries where plaque build up is present.
Calcium channel blocker:	A drug that inhibits calcium ion reflux into cells or inhibits the movement of intracellular calcium stores.
Caregiver:	A person who provides direct support for a stroke survivor, usually in the home.
Carotid artery:	The arteries on each side of the neck which carry blood from the heart to the brain. Each artery divides into internal and external carotid arteries. Each external carotid artery supplies blood to the neck and face. Each internal carotid artery supplies blood to the front part of the brain.

Carotid endarterectomy: The surgical removal of atherosclerotic plaque blocking or reducing blood flow in a carotid artery. It is performed when the artery is moderately to significantly diseased or blocked (more than 50 percent blockage).

Carotid stenosis: Narrowing of the carotid arteries caused by a buildup of plaque.

Cerebellar stroke: A stroke that strikes the cerebellum area of the brain, which controls balance and coordination.

Cerebellum: The second largest portion of the brain, responsible for coordinating voluntary muscle movements.

Cerebral edema: Swelling of the brain caused by an increase in intracellular water.

Cerebrovascular accident: A term traditionally used for stroke; also called CVA. The term is falling into disuse as we learn more about stroke's preventability and treatability. Stroke is no longer viewed as an accident.

Cerebrovascular disease: Known as CVD, cerebrovascular disease encompasses all abnormalities of the brain resulting from pathologies of its blood vessels. Stroke is the dominant, but not the only, form of CVD. Because of this dominance, the terms “stroke” and “cerebrovascular disease” are used interchangeably throughout literature. Examples of CVD outside of stroke include fibromuscular dysplasia, spontaneous dissecting carotid aneurysms, Moyamoya disease, and various inflammatory diseases of brain arteries.

Cerebrospinal fluid: The fluid that bathes the brain and spinal cord.

Cholesterol: A soft, waxy fat (lipid) in the bloodstream and in all body cells. Helps form cell membranes, some hormones and Vitamin D.

Cognition/cognitive: The process of knowing, including awareness, perception, reasoning, remembering, and problem solving.

Compensation: The ability of an individual with impairments from stroke to perform a task (or tasks) either using the impaired limb with an adapted (different) approach or using the unaffected limb to perform the task.

Continence: The ability to control bodily functions, especially urinary bladder and bowel functions.

Contracture: A condition of fixed, high resistance to passive stretching that results from fibrosis and shortening of tissues that support muscles or joints.

CT or "CAT" scanner:	A specialized form of X-ray that allows physicians to see the internal structure of the brain in precise detail.
Doppler ultrasound:	A method of measuring the velocity of blood flow through arteries and veins using sound waves.
Dysarthia:	A motor disorder that results in difficulty in motor speech mechanisms.
Dysphagia:	Inability and/or difficulty in swallowing.
Edema:	Swelling due to an excessive accumulation of watery fluid in cells or tissues.
Epidemiology:	The study of factors that influence the frequency and distribution of a disease in a population.
Embolic stroke:	A stroke resulting from the blockage of an artery by a blood clot (or embolus).
Emotional lability:	Instability or change of the emotions. In stroke survivors, emotional lability usually takes the form of inappropriate laughing or crying for no obvious reason.
Forced use:	Use of an impaired limb encouraged by restraining the unaffected limb and, hence, preventing it from taking over performance of required tasks.
Functional limitation:	Reduced ability or lack of ability to perform an action or activity in the manner or within the range considered to be normal.
Gait:	The manner or style of walking.
Glasgow Coma Scale:	A 15-point standardized system for recording response to stimuli in a neurologically impaired person.
Global aphasia:	A combination of expressive and receptive aphasia in which the patient is left with little if any communication skills.
Hematoma:	A localized mass of blood, usually clotted, confined within an organ, tissue or space.
Hemianopia:	Loss of vision on one half of one side of the visual field involving one or both eyes.
Hemiplegia:	Paralysis of one side of the body.
Hemorrhage:	The escape of blood from a ruptured blood vessel.
Hemorrhagic stroke:	A stroke caused by a ruptured blood vessel and characterized by a hemorrhage (bleeding) within or surrounding the brain.
Hypertension:	Elevated blood pressure.
Hypotonia:	Abnormally decreased muscle tone or strength.

Hypoxia:	Often mistaken for stroke, hypoxia refers to a lack of oxygen, in contrast to the lack of blood flow caused by stroke. Although the symptoms are similar to stroke, hypoxia is characterized by gait and speech disturbances, tremors and weakness. The brain may suffer from hypoxia even if blood flow and blood pressure are normal. Causes include chronic pulmonary disease, pulmonary emboli, alveolar hypotension, anemia and carbon monoxide poisoning.
Incidence:	Describes the frequency with which new and recurrent cases of a specific disease occur during a certain period of time in a quantitatively undefined population (e.g., annual stroke incidence in the United States is 750,000).
Incidence rate:	The number of new and recurrent cases of a disease that occur during a specified period of time per a defined number of individuals in a reference population (e.g., annual stroke incidence rate in African Americans is 288 per 100,000).
Incontinence:	Lack of control over excretory functions (urination, bowels).
Infarct:	The immediate area of brain cell death caused by a stroke. When the brain cells in the infarct die, they release chemicals that set off a chain reaction that endangers brain cells in a larger surrounding area, known as the penumbra.
Interdisciplinary treatment:	Treatment delivered to a patient by two or more medical or rehabilitative disciplines working collaboratively.
Intracerebral hemorrhage:	A stroke caused by bleeding within the brain.
Ischemia:	An interruption or blockage of blood flow to the brain.
Left hemisphere:	The left half of the brain. Controls actions of the right side of the body, as well as analytic abilities, such as calculating, speaking and writing.
Magnetic Resonance Imaging: (MRI)	A diagnostic imaging procedure that uses a magnetic field and radio waves to create images of internal structures of the body.
Mortality:	Describes the number of individuals who die from a specific disease during a certain period of time in a quantitatively undefined population (e.g., annual stroke mortality in the United States is 160,000).
Mortality rate:	The number of persons dying from a specific disease within a specific population during a certain period of time.

Motor control:	Ability to control movements of the body.
Neglect:	A lack of awareness of actions or objects on the left or right side of the body, caused by damage to the other side of the brain. For example, a stroke survivor with left-side neglect may forget about food on the left side of the dinner plate.
Neuroprotective agents:	Acute stroke interventional drugs which promise to protect brain cells, interrupting the process of secondary injury. Most experimental neuroprotectants must be administered within a six-hour "window of opportunity" to limit damage during stroke.
Occlusion:	Disruption of blood supply in a blood vessel, usually by a blood clot or atherosclerosis.
Penumbra:	An area of brain cells surrounding the initial site of brain damage from stroke. The brain cells in the penumbra are threatened by ischemic injury, but not irreversibly damaged.
Plaque:	A deposit of lipids in the inner lining of the artery often associated with atherosclerosis.
Platelets:	A component of blood that sticks together to form a plug, or clot, when certain substances beneath the blood vessel lining are exposed to circulating blood.
Prevalence:	The total number of individuals with a disease within a population group (e.g., stroke prevalence in the United States is 4 million).
Right hemisphere:	The right half of the brain. Controls the actions of the left side of the body.
Secondary injury:	Damage or death of brain cells in the larger area surrounding the infarct. Secondary injury is caused by a chain reaction of electrical and chemical events. Because this damage does not occur at the time of stroke, but in the hours following a stroke, it is critical to seek immediate medical treatment for stroke.
Spasticity:	Abnormally increased tone in a muscle.
Stenosis:	Reduction in the size of a vessel or other opening.
Stroke:	The sudden interruption of blood flow to a part of the brain that kills brain cells within the area. As a result, body functions controlled by the affected area may be impaired or lost.
Subarachnoid hemorrhage:	A stroke caused by bleeding under the thin, delicate membrane surrounding the brain.

Thrombolytic agents:	Acute interventional drugs which work directly to break up or dissolve stroke-causing clots. Thrombolytics were first used successfully to treat heart attacks. Many other thrombolytic drugs are in clinical trials. T-PA (tissue plasminigen activator) is the only FDA-approved acute stroke treatment.
Thromboembolism:	An embolus that originates in and breaks away from a clot on one vessel to become lodged in another vessel.
Thrombosis:	The clotting of blood within a vessel.
Thrombotic stroke:	A stroke resulting from the blockage of a blood vessel by accumulated deposits, with blockage made complete when a clot develops or lodges on top of the deposits, preventing the free flow of blood.
Transient ischemic attack:	Called TIAs, transient ischemic attacks are temporary interruptions of the blood supply to an area of the brain, typically caused by carotid stenosis. During a TIA, a person experiences a sudden onset of stroke symptoms. By definition, a TIA can last up to 24 hours, but most last only a few minutes and cause no permanent damage or disability. Sometimes called "mini-strokes," TIAs must be taken seriously because they are usually a precursor to full strokes.
Unilateral neglect:	A disturbance of a person's awareness of space on the side of the body opposite a stroke-causing lesion; often referred to as hemi-inattention.
Vertebrobasilar arteries:	The two arteries in the back of the neck which supply blood to the brain stem and cerebellum.

National Stroke Association

Mission

National Stroke Association's mission is to reduce the incidence and impact of stroke. Founded in 1984, NSA is the first national non-profit to devote 100 percent of its efforts and resources, including prevention, treatment, rehabilitation, research and support, to stroke survivors and their families.

Prevention

NSA's Prevention Programs offer a number of dynamic screening tools to assess a patient's level of stroke risk, as well as prevention education materials to teach patients about stroke risk factors and stroke symptoms (some materials also available in Spanish).

Public Health Outreach allows NSA to partner with state and local public health departments to spread stroke prevention messages.

The ethnic disparities initiative focuses attention on minority populations and implements targeted prevention and education campaigns to reduce the incidence of stroke in high-risk minority groups such as African-Americans, Hispanics, Native Americans and Asian Pacific Islanders.

Acute Treatment

NSA's Stroke Center Network is a membership program of clinicians, researchers and facilities committed to developing stroke centers of excellence. Through a wide range of member-only benefits, the program offers education, materials and support to members in an effort to improve the quality of stroke prevention and care from the initial emergency through rehabilitation.

NSA's Acute Treatment Program (ATP) assists hospitals of all sizes in providing the best stroke care possible. Through site visits, personal consultations and specific recommendations, NSA has a direct impact on the outcomes of stroke patients.

Co-authored by NSA and published in *JAMA*, the Stroke Center Guidelines will allow hospitals across the country to improve their stroke care by implementing a standard set of recommendations.

Rehabilitation/Recovery

NSA provides guidance and support to stroke survivors, families and caregivers through literature and referrals to NSA chapters and stroke support groups.

To provide stroke survivors and their families with user-friendly and complete information on discharge from the hospital, NSA developed *HOPE: The Stroke Recovery Guide*. Distributed to rehabilitation hospitals across the country, the guide gives new survivors and their caregivers an effective tool to manage life after stroke.

Through the leadership of its Rehabilitation Advisory Board, NSA is spearheading the development of the leading guide for best practices in rehabilitation.

Advocacy & Community Outreach

Through aggressive advocacy efforts, NSA has formed alliances with key governmental leaders such as mayors, governors and state legislators to elevate stroke in their agendas.

NSA has a growing network of chapters that allows us to implement national programs on a local level. These affiliates are extensions of NSA and host a wide variety of prevention and fund-raising events while serving as vehicles for local service delivery.

Exhibitions, meetings and medical symposia throughout the year allow NSA to continue its efforts to educate both the public and medical professionals about stroke.

Advancements in stroke research are supported through NSA's Research Fellowship program. Funneling this support into local communities through medical facilities and universities, NSA is influencing the future of stroke treatment and recovery.

The Voice for Stroke

Obtain information, resources and statistics on all aspects of stroke on NSA's web site at www.stroke.org or by calling the hotline, 1-800-STROKES (1-800-787-6537). With almost 2 million hits per month, NSA's web site is the leading resource for stroke information on the Internet.

Valuable and potentially life-saving information is provided to the public through NSA's brochures, fact sheets, books and audio-visual materials on stroke prevention, treatment and rehabilitation. NSA also publishes the bi-monthly magazine *Stroke Smart*, featuring news, support and tips for survivors, families, caregivers, healthcare providers and others who are touched by stroke. To receive a sample issue of *Stroke Smart*, register on www.stroke.org or call 1-800-STROKES (800-787-6537).

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