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For patients

Stroke

A stroke occurs when blood flow to a part of the brain is interrupted as a result of a broken or blocked blood vessel. Stroke may be hemorrhagic or ischemic. A hemorrhagic stroke occurs when a blood vessel in the brain ruptures or breaks, allowing blood to leak into the brain. An ischemic stroke occurs when a blood vessel carrying blood to the brain is blocked or restricted by severely narrowed arteries or a blood clot.

Because treatment depends on the type of stroke, your doctor may use head CT or head MRI to help diagnose your condition. Other tests may include blood tests, electrocardiogram (ECG or EKG), carotid ultrasound, echocardiography or cerebral angiography. Immediate stroke treatment can help save lives and reduce disability by restoring blood flow for an ischemic stroke or controlling bleeding and reducing pressure on the brain in the case of a hemorrhagic stroke.

What is a stroke?

A stroke happens when blood flow to a part of the brain is interrupted as a result of a ruptured or blocked blood vessel. Brain cells that do not receive a constant supply of oxygenated blood may die, causing permanent damage to the brain.

There are two types of strokes: hemorrhagic and ischemic.

A hemorrhagic stroke (http://www.radiologyinfo.org) occurs when a blood vessel in the brain ruptures or breaks, allowing blood to leak into the brain.

An ischemic stroke (http://www.radiologyinfo.org) occurs when a blood vessel carrying blood to the brain is blocked or restricted by severely narrowed arteries or a thickened mass of blood called a blood clot (http://www.radiologyinfo.org) .

- *Clogged arteries:* Fat, cholesterol and other substances can collect on the walls of blood vessels. Over time, these substances harden and form structures called plaque (http://www.radiologyinfo.org) . The build-up of fat deposits and plaque clog arteries, narrowing the passageway for blood.
- *Blood clots:* When a clot forms in a cerebral (http://www.radiologyinfo.org) blood vessel that is already very narrow, it is called a thrombotic stroke (http://www.radiologyinfo.org) . When a blood clot that has formed elsewhere in the body breaks away and travels to a blood vessel in the brain, the result is an embolic stroke (http://www.radiologyinfo.org) , or cerebral embolism. An embolic stroke may also result from an air bubble or other foreign substance in the blood that moves into and blocks a cerebral blood vessel.

A short episode of stroke-like symptoms is called a transient ischemic attack (TIA) (http://www.radiologyinfo.org) or mini-stroke. Most often, no permanent damage results from a TIA; however, a TIA is often a warning sign that a stroke will occur. Symptoms of a TIA may last from a few minutes to up to 24 hours.

The symptoms of stroke depend on which part of the brain is affected. In some cases, a person may not know that he or she has had a stroke. Symptoms, which usually develop suddenly and without warning, include:

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

How is a stroke diagnosed and evaluated?

The first step in assessing a stroke patient is to determine whether the patient is experiencing an ischemic or hemorrhagic stroke so that the correct treatment can begin. A CT scan or MRI of the head is typically the first test performed.

- Computed tomography (CT) of the head (https://www.radiologyinfo.org/en/info/headct) : CT scanning combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. Physicians use CT of the head to detect a stroke from a blood clot or bleeding within the brain. To improve the detection and characterization of stroke, *CT angiography (CTA) (https://www.radiologyinfo.org/en/info/angioct)* may be performed. In CTA, a contrast material (http://www.radiologyinfo.org) may be injected intravenously and images are obtained of the cerebral blood vessels. Images that detect blood flow, called *CT perfusion (CTP) (https://www.radiologyinfo.org/en/info/perfusionheadct)* , may be obtained at the same time. The combination of CT, CTA and CTP can help physicians decide on the best therapy for a patient experiencing a stroke.
- MRI of the head (https://www.radiologyinfo.org/en/info/mri-brain) : MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. MR is also used to image the cerebral vessels, a procedure called *MR angiography (MRA) (https://www.radiologyinfo.org/en/info/angiomr)* . Images of blood flow are produced with a procedure called MR perfusion (MRP). Physicians use MRI of the head to assess brain damage from a stroke.

To help determine the type, location, and cause of a stroke and to rule out other disorders, physicians may use:

- Blood tests.
- Electrocardiogram (ECG, EKG) (http://www.radiologyinfo.org) : An electrocardiogram, which checks the hearts' electrical activity, can help determine whether heart problems caused the stroke.
- *Carotid ultrasound (https://www.radiologyinfo.org/en/info/us-carotid)* /Doppler ultrasound: Ultrasound imaging involves exposing part of the body to high-frequency sound waves to produce pictures of the inside of the body. Physicians use a special ultrasound technique called Doppler ultrasound (http://www.radiologyinfo.org) to check for narrowing and blockages in the body's two carotid arteries (http://www.radiologyinfo.org) , which are located on each side of the neck and carry blood from the heart to the brain. Doppler ultrasound produces detailed pictures of these blood vessels and information on blood flow.
- *Cerebral angiography (https://www.radiologyinfo.org/en/info/angiocerebral)* . Angiography (http://www.radiologyinfo.org) is a medical test that is performed with one of three imaging technologies—x-rays (http://www.radiologyinfo.org) , CT or MRI, and in some cases a contrast material, to produce pictures of major blood vessels in the brain. Cerebral angiography helps physicians detect or confirm abnormalities such as a blood clot or narrowing of the arteries.

How is a stroke treated?

A stroke is a medical emergency. Immediate treatment can save lives and reduce disability. Treatment depends on the severity and type of stroke. Treatment will focus on restoring blood flow for an ischemic stroke and on controlling bleeding and reducing pressure on the brain in a hemorrhagic stroke.

If a stroke is caused by a blood clot, the patient may be able to receive a clot-busting drug such as tissue plasminogen activator (t-PA) (http://www.radiologyinfo.org) to dissolve the clot and help restore blood flow to the damaged area of the brain. Clot-

busting drugs, which can only be given within the first few hours of stroke onset, are typically delivered intravenously by emergency medical personnel or in the hospital emergency department.

Patients may also receive blood-thinning drugs such as aspirin (http://www.radiologyinfo.org) or warfarin (http://www.radiologyinfo.org) (also called by the brand name, Coumadin®), heparin (http://www.radiologyinfo.org) or clopidogrel (http://www.radiologyinfo.org) (also called by the brand name Plavix®).

Other stroke treatments include:

- Surgery to remove blood from around the brain and repair damaged blood vessels.
- *Intracranial vascular treatments (https://www.radiologyinfo.org/en/info/intracranialvasc)* : Endovascular therapy is a minimally invasive (http://www.radiologyinfo.org) procedure used to improve blood flow in the brain's arteries and veins. In endovascular therapy, an image-guided catheter is navigated through the body's blood vessels to the brain to deliver:
  - medications to dissolve blood clots.
  - mechanical retrievers and aspiration systems that help remove blood clots or debris in cerebral arteries.
  - devices such as balloons (http://www.radiologyinfo.org) , which are used to open markedly narrowed blood vessels, and stents (http://www.radiologyinfo.org) , small tubes used to keep blood vessels open. In this procedure, which is used to improve blood flow in the carotid arteries that supply blood to the brain, a balloon-tipped catheter (http://www.radiologyinfo.org) is guided to where the artery is narrow or blocked and inflated to open the vessel. A small wire mesh tube called a stent may be placed in the artery to help keep it open.
  - tiny metal coils to repair a ruptured aneurysm (http://www.radiologyinfo.org) in a cerebral artery

Following a stroke, many patients will receive post-stroke rehabilitation to overcome disabilities that may occur as a result of the stroke. Post-stroke treatment may also include efforts to prevent another stroke by controlling or eliminating risk factors such as high blood pressure, high cholesterol and diabetes.

Which test, procedure, or treatment is best for me?

- *Acute Mental Status Change, Delirium, and New Onset Psychosis (https://www.radiologyinfo.org/en/info/acs-acute-mental-status-change-delirium-psychosis)*

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