

## Ruptured Aneurysm basic level

### Overview

An aneurysm is a balloon-like bulge or weakening of an artery wall. As an aneurysm enlarges it puts pressure on surrounding structures, causing headache or vision problems, and may eventually rupture. A ruptured aneurysm releases blood into the spaces around the brain, called a subarachnoid hemorrhage (SAH) – a life-threatening type of stroke. Treatment focuses on stopping the bleeding and repairing the aneurysm with surgical clipping, coiling, or bypass.

### What is a ruptured aneurysm?

An aneurysm is a balloon-like bulge or weakening of an arterial wall. As the bulge grows it becomes thinner and weaker. It can become so thin that the blood pressure within can cause it to burst or leak. Most aneurysms develop from a weakness or abnormal artery wall. Aneurysms usually occur on larger blood vessels where an artery branches. Approximately 80% of aneurysms form in the front (anterior circulation) of the brain, while 20% form in the back (posterior circulation) of the brain (see Anatomy of the Brain). Types of aneurysms include (Fig. 1):

- **Saccular** - (most common, also called "berry") the aneurysm bulges from one side of the artery and has a distinct neck at its base.
- **Fusiform** - the aneurysm bulges in all directions and has no distinct neck.
- **Giant** - may be saccular or fusiform and measures more than 2.5 cm in diameter; the neck is often wide and may involve more than one artery.
- **Traumatic** – caused by a closed head injury or penetrating trauma.

A ruptured aneurysm releases blood into the spaces around the brain, called a subarachnoid hemorrhage (SAH). SAH is life threatening with a 50% risk of death. Blood in the subarachnoid space increases pressure on the brain. At the same time, the area of brain that previously received oxygen-rich blood from the affected artery is now deprived of blood, resulting in a stroke.

A complication that occurs 5 to 10 days after aneurysm rupture is vasospasm. Irritating blood byproducts cause the walls of an artery to spasm and narrow, reducing blood flow to that region of the brain and causing a secondary stroke.

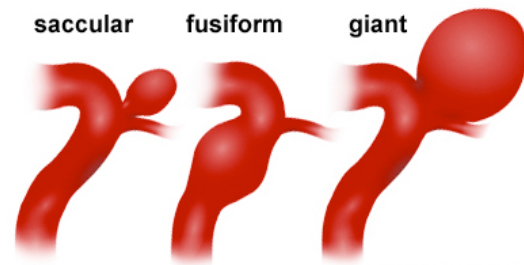
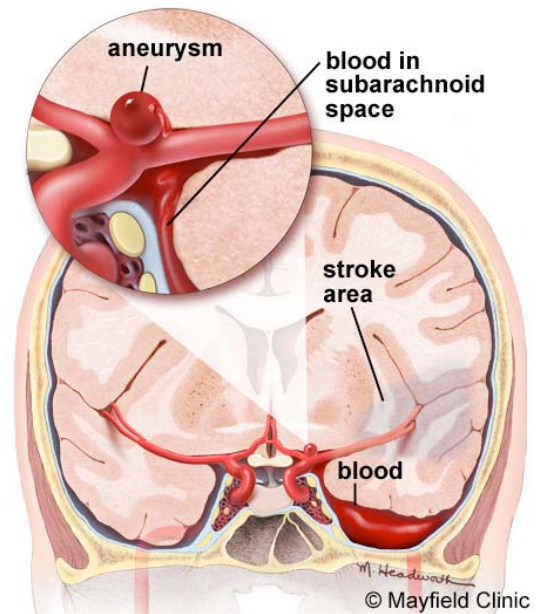


Figure 1. A ruptured aneurysm releases blood into the subarachnoid space (above). Different types of aneurysms (below).

### What are the symptoms?

Most aneurysms don't have symptoms until they rupture. Rupture usually occurs while a person is active rather than asleep. If you experience the symptoms of a SAH, call 911 immediately!

- Sudden onset of a severe headache (often described as "the worst headache of my life")
- Nausea and vomiting
- Stiff neck
- Sensitivity to light (photophobia)
- Blurred or double vision
- Loss of consciousness
- Seizures

### What are the causes?

Risk factors for aneurysmal SAH currently being studied are smoking, high blood pressure, alcohol, genetic (family inherited), atherosclerosis, oral contraceptives, and lifestyle.

## Who is affected?

Approximately 5% of the population may have or acquire an aneurysm; of those, 20% have multiple aneurysms. Unruptured aneurysms are more common (2.7 million per year) than ruptured (20,000 per year). However, 85% of aneurysms are not diagnosed until after they rupture. Aneurysms are usually diagnosed between ages 35 to 60 and are more common in women.

## How is a diagnosis made?

When a patient is brought to the emergency room with a suspected ruptured aneurysm, doctors will learn as much as possible about his or her symptoms, current and previous medical problems, medications, and family history. A physical exam will be performed. Diagnostic tests will help determine the source of the bleeding.

- **Computed Tomography (CT)** scan is a noninvasive X-ray that provides images of anatomical structures within the brain. It is especially useful to detect blood in or around the brain. A newer technology called CT angiography (CTA) involves the injection of contrast into the blood stream to view the arteries of the brain. CTA provides the best pictures of blood vessels (through angiography) and soft tissues (through CT).
- **Lumbar puncture** is an invasive procedure in which a hollow needle is inserted into the subarachnoid space of the spinal canal to detect blood in the cerebrospinal fluid (CSF). The doctor will collect 2 to 4 tubes of CSF.
- **Angiogram** is an invasive procedure in which a catheter is inserted into an artery and passed through the blood vessels to the brain. Once the catheter is in place, contrast dye is injected into the bloodstream and x-rays are taken.
- **Magnetic Resonance Imaging (MRI)** scan is a noninvasive test that uses a magnetic field and radio-frequency waves to give a detailed view of the soft tissues of the brain. An MRA (Magnetic Resonance Angiogram) is the same non-invasive study, except that it is also an angiogram, which means it examines the blood vessels in addition to structures of the brain.

## What treatments are available?

Treatment may include lifesaving measures, symptom relief, repair of the bleeding aneurysm, and complication prevention. For 10 to 14 days following an aneurysm rupture, the patient will remain in the neuroscience intensive care unit (NSICU), where doctors and nurses can watch closely for signs of renewed bleeding, vasospasm, hydrocephalus, and other potential complications.

### Medication

Pain medication will be given to alleviate headache, anticonvulsant medication may be prescribed to prevent or treat seizures, and a vasodilator will be prescribed to prevent vasospasm. Blood pressure is lowered to reduce further bleeding and to control intracranial pressure.

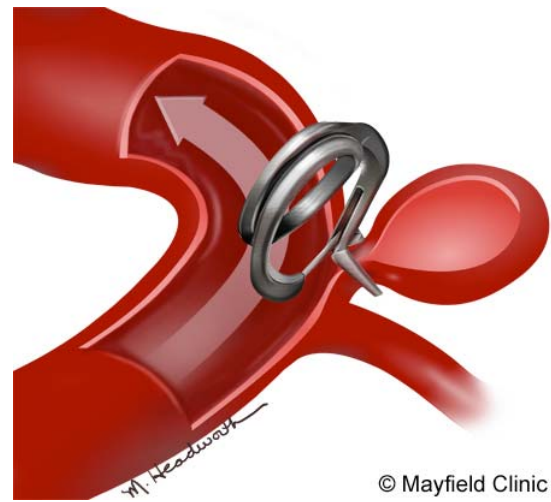


Figure 2. A titanium clip is placed across the neck of an aneurysm. The arrow demonstrates blood flow through the artery, but not the aneurysm.

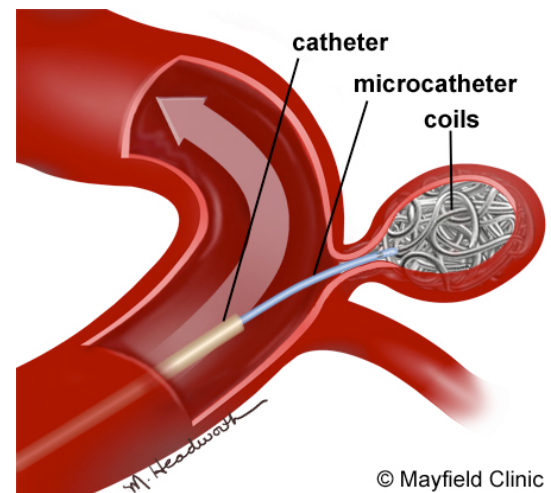


Figure 3. The aneurysm is packed with platinum coils by way of a small catheter.

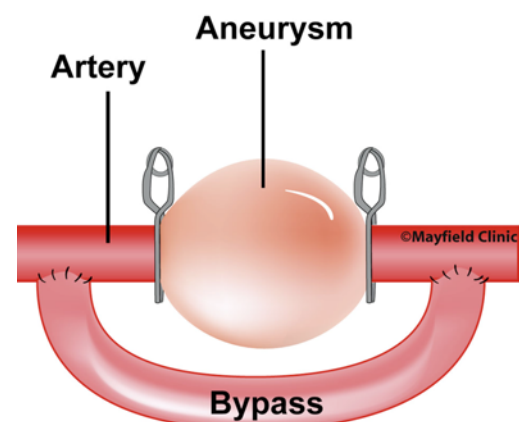


Figure 4. The aneurysm is blocked off between two clips and a bypass is sewn to detour blood flow around the aneurysm.

## Surgery

Determining the best surgical treatment for a ruptured aneurysm involves many factors, such as the size, location, and type of aneurysm as well as the overall health of the patient and their medical history.

- **Surgical clipping:** an opening is made in the skull, called a craniotomy, to locate the aneurysm. A small clip is placed across the "neck" of the aneurysm to block the normal blood flow from entering (Fig. 2). The clip is made of titanium and remains on the artery permanently.
- **Endovascular coiling:** is performed during an angiogram in the radiology department and sometimes requires general anesthesia. A catheter is inserted into an artery in the groin and then passed through the blood vessels to the aneurysm. Through the catheter, the aneurysm is packed with platinum coils or acrylic glue, which prevents blood flow into the aneurysm (Fig. 3).
- **Artery occlusion and bypass:** if surgical clipping is not possible or the artery is too damaged, the surgeon may completely block (occlude) the artery that has the aneurysm. The blood flow is detoured (bypassed) around the occluded section of artery by inserting a vessel graft (Fig. 4). The graft is a small artery, usually taken from your leg, that is connected above and below the blocked artery so that blood flow is rerouted (bypassed) through the graft.

A bypass can also be created by detaching a donor artery from its normal position on one end, redirecting it to the inside of the skull, and connecting it above the blocked artery. This is called a STA-MCA (superficial temporal artery to middle cerebral artery) bypass.

## Clinical trials

Clinical trials are research studies in which new treatments—drugs, diagnostics, procedures, and other therapies—are tested in people to see if they are safe and effective. Research is always being conducted to improve the standard of medical care. Information about current clinical trials, including eligibility, protocol, and locations, are found on the Web. Studies can be sponsored by the National Institutes of Health (see [clinicaltrials.gov](http://clinicaltrials.gov)) as well as private industry and pharmaceutical companies (see [www.centerwatch.com](http://www.centerwatch.com)).

## Recovery and prevention

The possibility of having a second bleed is 35% within the first 14 days after the first bleed. This is why neurosurgeons prefer to do direct surgical or endovascular treatment as soon as the aneurysm is diagnosed, so that the risk of a rebleed is lessened.

A common complication of SAH is vasospasm, which is a narrowing (spasm) of an artery that may occur 5 to 10 days following a SAH. In the ICU you will be monitored every hour or so for signs of vasospasm which include arm or leg weakness, confusion, sleepiness, or restlessness (see SAH).

Aneurysm patients may suffer short-term and/or long-term deficits as a result of a rupture or treatment. Some of these deficits may disappear over time with healing and therapy. The recovery process is long and may take months or years to understand the deficits you incurred and regain function.

## Sources & links

If you have more questions, please contact the Mayfield Clinic at 800-325-7787 or 513-221-1100.

### Links

The Brain Aneurysm Foundation  
[www.bafound.org](http://www.bafound.org) or 617-723-3870

[www.brainaneurysm.com](http://www.brainaneurysm.com)

Tri-State Brain Aneurysm Support Group  
[www.tsbaconnex.org](http://www.tsbaconnex.org)

## Glossary

**aneurysm:** a bulge or weakening of an arterial wall.

**coiling:** a procedure to insert platinum coils into an aneurysm; performed during an angiogram.

**craniotomy:** surgical opening in the skull.

**embolization:** inserting material, coil or glue, into an aneurysm so blood can no longer flow through it.

**subarachnoid hemorrhage:** bleeding in the space surrounding the brain; may cause a stroke.

**vasospasm:** abnormal narrowing or constriction of arteries due to irritation by blood in the subarachnoid space.

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reviewed by > Mario Zuccarello, MD  
Nancy McMahon, RN



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