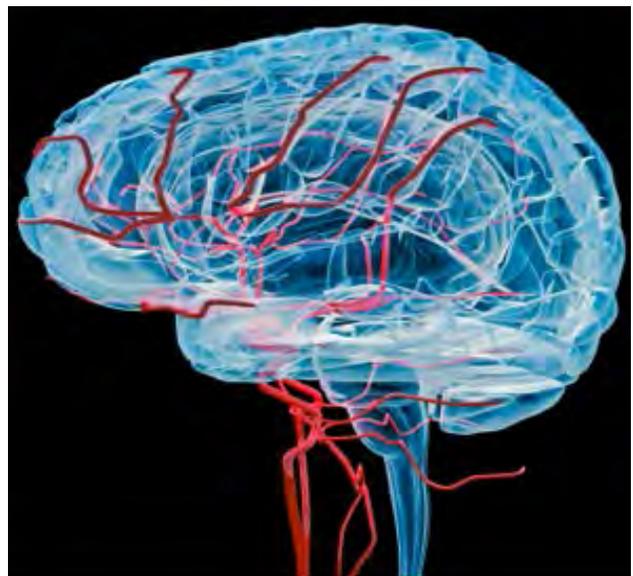




**Subarachnoid
Hemorrhage
Information
Booklet**

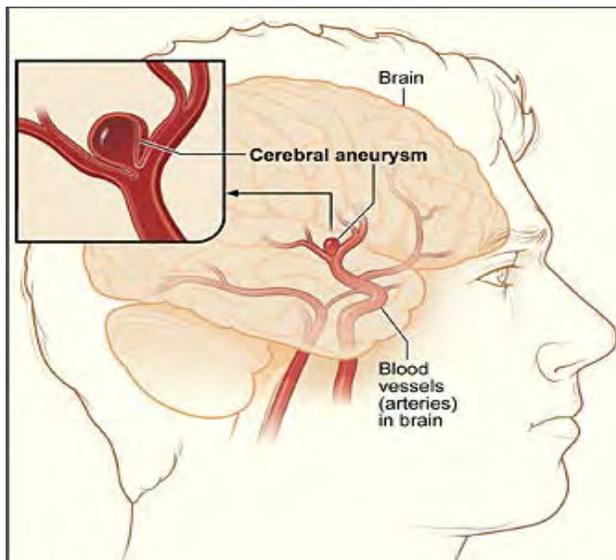


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Subarachnoid Hemorrhage

What is a Subarachnoid Hemorrhage?

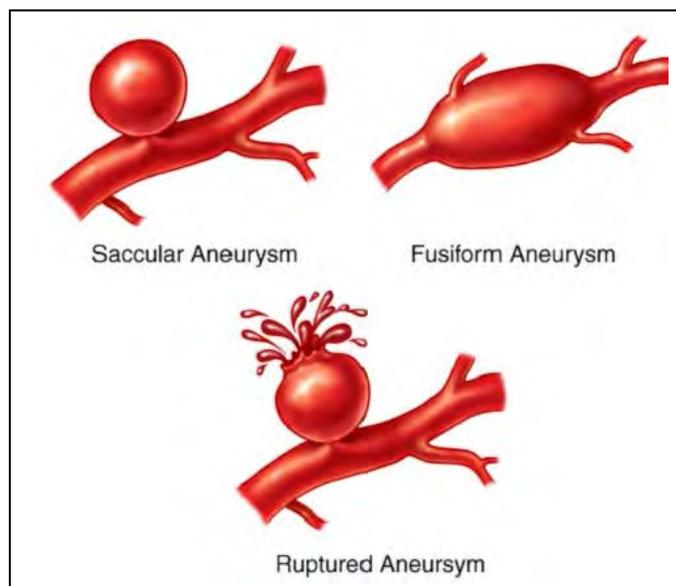
A subarachnoid hemorrhage is bleeding from a damaged artery at the surface of the brain. This bleeding is caused by an abnormal bulge or ballooning (dilation) in the wall of an artery in the brain caused by the pressure of blood flowing through a weakened area. This bleeding often causes a sudden, severe headache. It is a medical emergency. Subarachnoid hemorrhage is a type of stroke. It can cause permanent brain damage.



Aneurysms that occur in the brain are called cerebral aneurysms. They are sometimes called berry aneurysms because they are often the size of a small berry. Most cerebral aneurysms produce no symptoms until they become large, begin to leak blood, or rupture.

Most often, a subarachnoid hemorrhage happens because a bulge in the wall of an artery ruptures. The sac-like bulge is called a saccular aneurysm. A subarachnoid hemorrhage also can occur because blood leaks from an abnormal tangle of blood vessels called an arteriovenous malformation (AVM).

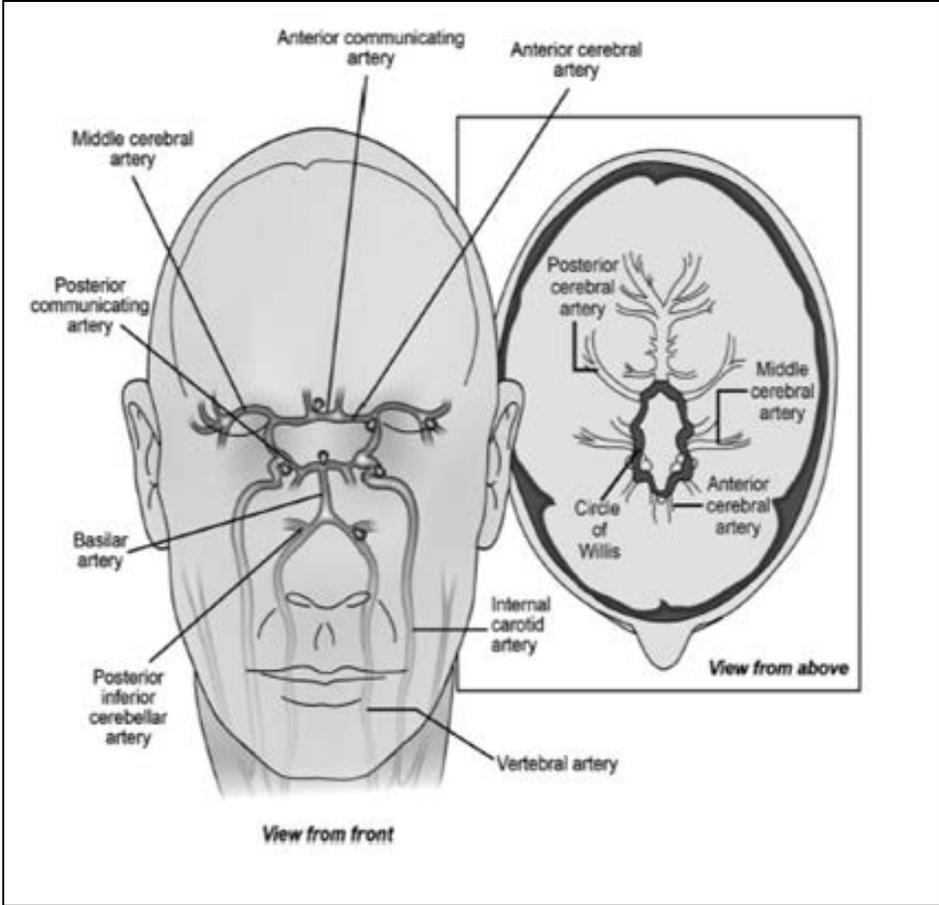
Types
of
aneurysms



Blood from a subarachnoid hemorrhage leaks into the space between the brain and the skull. It mixes with the cerebrospinal fluid that cushions the brain and spinal cord. As blood flows into the cerebral spinal fluid, it increases the pressure that surrounds the brain. The increased pressure can interfere with brain function.

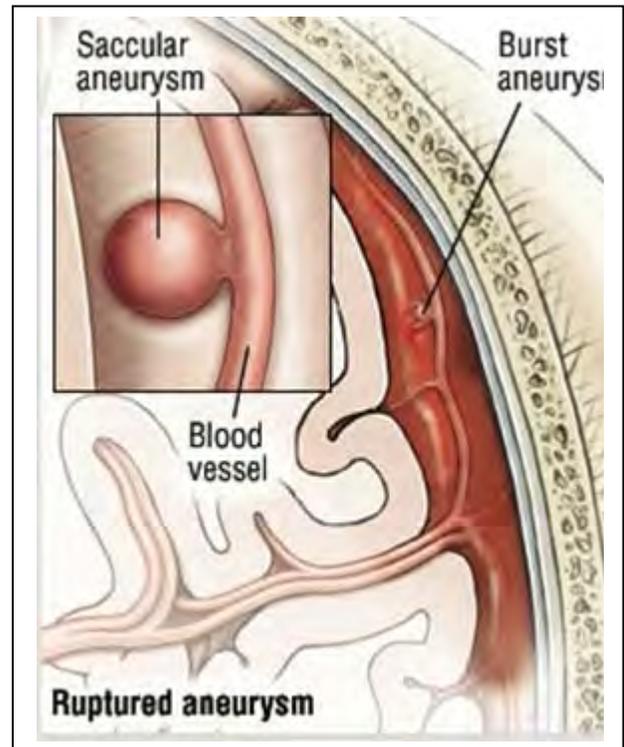
In the days that immediately follow the bleeding, chemical irritation from clotted blood around the brain can cause brain arteries to go into spasm. An artery spasm can cause additional new brain damage.

**Common locations for saccular aneurysms
in the brain**

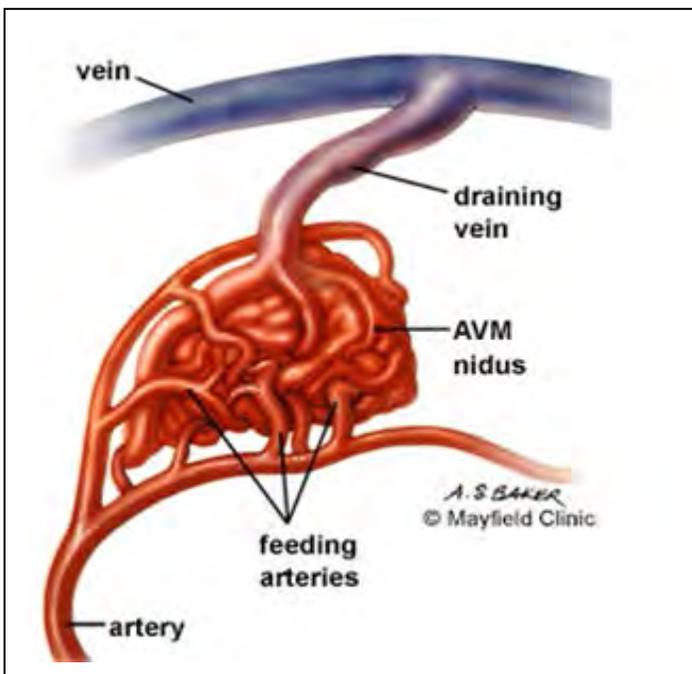


Ruptured Aneurysm

Several large arteries form a circle at the base of your brain. When a subarachnoid hemorrhage is caused by a ruptured saccular aneurysm, the aneurysm usually is located where a blood vessel branches from one of these large arteries. About 20% of patients who have had a subarachnoid hemorrhage have multiple aneurysms. Although it is not possible to predict whether an aneurysm will rupture, an aneurysm is more likely to rupture when it has a diameter of 7 millimeters or more. In most cases, a person who has a brain aneurysm never has a symptom related to it.

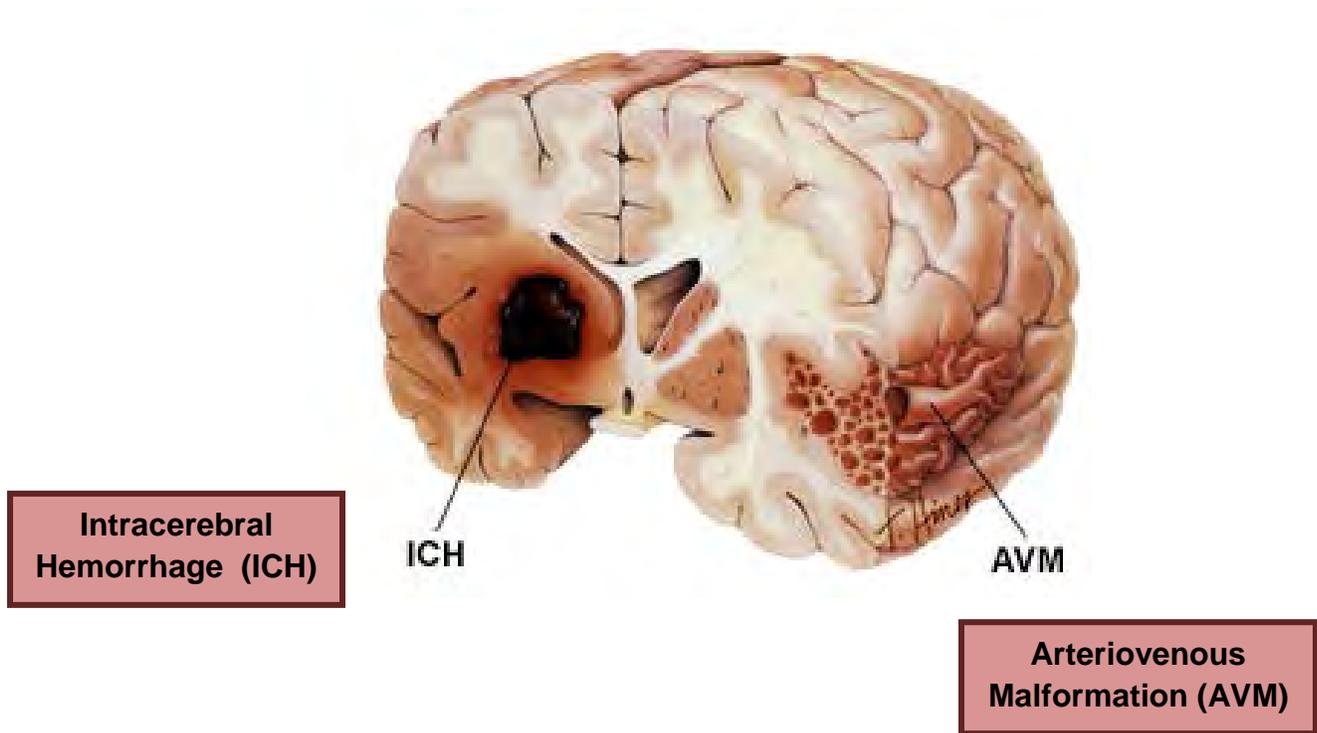


Leaking Arteriovenous Malformation (AVM)



An AVM is a tangled, abnormal mesh of blood vessels that connects an artery and a vein in the brain. AVMs form accidentally prior to birth. An AVM can form almost anywhere in the brain or spinal cord, but they usually are near the back of the brain.

AVMs can appear in several generations of the same family and are more common in men. Bleeding from an AVM most often occurs between the ages of 10 and 30. If an AVM is too deep to cause bleeding onto the outer surface of the brain (a subarachnoid hemorrhage), it can cause bleeding inside the brain itself



Symptoms

The symptoms of a subarachnoid hemorrhage can include:

- **Very severe, sudden headache (Some people say the start of this headache is like a thunderclap.)**
- **Nausea and vomiting**
- **Inability to look at bright light**
- **Stiff neck**
- **Dizziness**
- **Confusion**
- **A seizure**
- **Loss of consciousness**

If you have only a small subarachnoid hemorrhage, you may have several of these symptoms, particularly a severe headache that starts suddenly. However, your symptoms may improve on their own. This can be a critical warning sign, called a sentinel headache. People who have a small subarachnoid hemorrhage may have a second hemorrhage within the next week if they do not get medical treatment.

In the several days that follow a subarachnoid hemorrhage, it is possible to develop more typical symptoms of a stroke, from damage of specific areas of the brain. Examples of these symptoms include:

- Weakness, paralysis or numbness of one side or one part of the body
- Difficulty speaking
- Difficulty walking
- Coma

Diagnosis

If you have a subarachnoid hemorrhage, you will be ill enough that you need to be evaluated in an emergency room. The doctor will do a physical examination, including a neurological examination, and will check to see if your neck movement is limited or uncomfortable, which can be a sign that there is an irritant such as blood in the spinal fluid.

One of two brain imaging tests will be used: either a computed tomography (CT) scan or magnetic resonance imaging (MRI) scan.

Computed tomography (CT) of the head is a fast, painless, noninvasive diagnostic tool that can reveal the presence of a cerebral aneurysm and determine if blood has leaked into the brain for those aneurysms that have burst. This is often the first procedure ordered by a physician following a suspected rupture. CT images of the head are processed by a computer as two-dimensional cross-sectional images, or “slices,” of the brain and skull. Occasionally a contrast dye is injected into the bloodstream prior to scanning. This process, called *CT angiography*, produces sharper, more detailed images of blood flow in the brain arteries. CT is usually conducted at a testing facility or hospital outpatient setting.



Magnetic resonance imaging (MRI) uses computer-generated radio waves and a powerful magnetic field to produce detailed images of the brain and other body structures. **Magnetic resonance angiography (MRA)** produces more detailed images of blood vessels. The images may be seen as either three-dimensional pictures or two-dimensional cross-slices of the brain and vessels. These painless, noninvasive procedures can show the size and shape of an unruptured aneurysm and can detect bleeding in the brain.

Angiography is a dye test used to analyze the arteries or veins. An *intracerebral angiogram* can detect the degree of narrowing or obstruction of an artery or blood vessel in the brain, head, or neck, and can identify changes in an artery or vein such as a weak spot like an aneurysm. It is used to diagnose stroke and to precisely determine the location, size, and shape of a brain tumor, aneurysm, or blood vessel that has bled. This test is usually performed in a hospital angiography suite. Following the injection of a local anesthetic, a flexible catheter is inserted into an artery and threaded through the body to the affected artery. A small amount of contrast dye (one that is highlighted on x-rays) is released into the bloodstream and allowed to travel into the head and neck. A series of x-rays is taken and changes, if present, are noted.



A lumbar puncture, also called a spinal tap, can confirm that you have a subarachnoid hemorrhage even when the hemorrhage is too small to appear on a CT scan. This test also can test whether you have meningitis, an infection that can cause similar symptoms. During a lumbar puncture, a small sample of cerebrospinal fluid is removed through a needle inserted into your back. This fluid is examined to see if it contains blood.

Two other tests, called brain angiography and MRI angiography, can evaluate blood flow patterns within your brain. One of these tests can be used to detect an aneurysm or AVM abnormality.

You also may have an electrocardiogram (EKG). The dramatic stress on the brain during a subarachnoid hemorrhage can trigger chemical changes within your heart muscle. These changes can stress the heart muscle and may result in a heart attack, even if your heart arteries are not narrowed by atherosclerosis.

Treatment of an Aneurysm

When a large hemorrhage occurs in or around the brain, the entire brain is in danger because of increasing pressure within the skull. Much of the emergency treatment for hemorrhagic stroke involves measuring and lowering this pressure. The person may need to be hooked up to a breathing machine (ventilator). This is done to make the person breathe faster and more deeply to lower the carbon dioxide level in the blood. This helps lower pressure around the brain. Also intravenous medications can be given to decrease the pressure.

Blood pressure must be kept in a tight range. Blood pressure that gets too low can be even more dangerous than high readings.

Subarachnoid hemorrhages commonly cause arteries nearest to the site of bleeding to spasm and become narrower. Nimodipine, a medicine that is a calcium channel blocker is given to prevent the spasm from further damaging the brain. This medication will be given for 21 days to decrease any spasms that may occur.

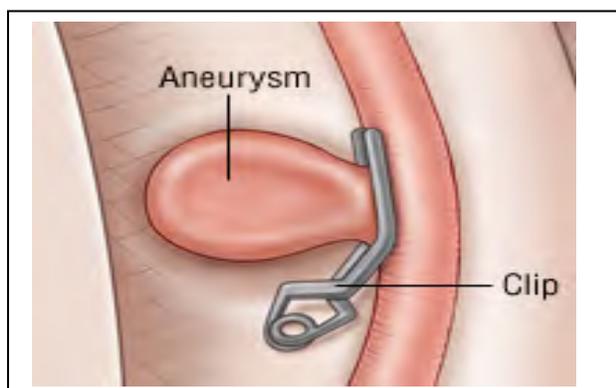
A subarachnoid hemorrhage frequently causes shifts in the level of blood chemicals called electrolytes. Your doctor will adjust the amount of chemicals in the intravenous fluids based upon results of daily blood tests.

If bleeding occurred because of an abnormally formed blood vessel, you will likely need a procedure to prevent recurrent bleeding. Ideally the procedure is performed when your condition is more stable.

For an aneurysm, your doctor may recommend endovascular coiling or aneurysm clipping.

1. Endovascular Clipping

Clipping of an aneurysm requires that you will have brain surgery to have a small clip attached to the base of the aneurysm. The clip will prevent any further blood from entering the aneurysm which will prevent future bleeding. You will return to the ICU after surgery where the nurses will provide close monitoring and comfort measures. You will return from surgery with a white turban on your head to protect the incision from infection and to keep swelling to a minimum. In preparation for the surgery, your neurosurgeon may clip some of the hair around the surgical area.



Aneurysm clipping requires brain surgery. The brain surgeon places a small metal clip across the base of the aneurysm.

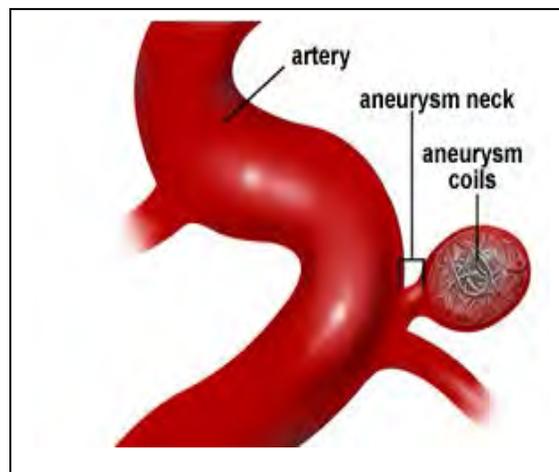
2. Endovascular Aneurysm Coiling

Coiling is a minimally invasive endovascular procedure performed to treat an aneurysm – a balloon-like bulge of an artery wall. As an aneurysm grows, it thins and weakens. It can become so thin that it leaks or ruptures, releasing blood into the space around the brain. This bleeding is called a subarachnoid hemorrhage (SAH) and is life threatening. During coiling, tiny coils are packed into the aneurysm to promote blood clotting and close off the aneurysm. Coils accomplish from the inside what a surgical clip would accomplish from the outside: they stop blood from flowing into the aneurysm but allow blood to flow freely through the normal arteries.

What is aneurysm coiling?

The goal of endovascular coiling is to isolate an aneurysm from the normal circulation without blocking off any small arteries nearby or narrowing the main vessel. Endovascular describes the minimally invasive technique of accessing the aneurysm from within the bloodstream, specifically during angiography. The bloodstream is entered through the large femoral artery in the upper leg (groin area). A flexible catheter is advanced from the femoral artery to one of four arteries in the neck that lead to the brain. While viewing an x-ray monitor, called a fluoroscope, the doctor steers the catheter through the blood vessels. A special dye injected into the bloodstream makes the blood vessels visible on the monitor. The result is a kind of roadmap of the arteries.

Once the catheter reaches the aneurysm, a very thin platinum wire is inserted. The wire coils up as it enters the aneurysm and is then detached. Multiple coils are packed inside the dome to block normal blood flow from entering. Over time, a clot forms inside the aneurysm, effectively removing the risk of aneurysm rupture. Coils remain inside the aneurysm permanently. Coils are made of platinum and other materials, and come in a variety of shapes, sizes, and coatings that promote clotting.



An AVM sometimes can be destroyed by a carefully directed beam of radiation or can be removed through surgery. Another technique is called embolization. A catheter is threaded through a blood vessel and guided to the AVM. The doctor injects special material or a chemical into the AVM to block off blood supply.

Physical Changes

Neurological:

Patients with a subarachnoid hemorrhage may have weakness and/or other issues during their hospitalization. Some common problems are:

- Arm or leg weakness
- Problems speaking
- Balance and walking issues
- Memory problems



Some of these changes are obvious and can interfere with your daily tasks. Other problems may be recognized only by you or your family members such as problems with thinking and thought processes.

Many of these problems improve with time, but ongoing care by a physical therapist (PT), occupational therapist (OT), and speech therapist (ST) can be very helpful and should be considered even when these problems are minor.

In most patients reaction time is slower during recovery for at least some period of time. It is not safe to drive under these circumstances. Follow your doctor's advice regarding your return to driving. This varies from person to person. If you have memory, visual, or other physical problems, you should not attempt to drive.

Visual:

Some patients have specific problems with vision due to the location of the aneurysm. Others have problems with focusing or blurry vision as a result of the subarachnoid hemorrhage. Problems with focus and blurred vision are common and tend to improve over time. If vision problems do not improve, contact your doctor.

Lack of smell and/or taste:

Patients often report changes in their ability to taste and/or smell. If the aneurysm ruptured, smell and taste problems can be caused by blood that irritates the nerves that control taste and smell. If the aneurysm did not rupture, the same smell and taste problems can be caused if the aneurysm is located in an area that presses the nerves surrounding it. Unfortunately, these problems may not get better with time.

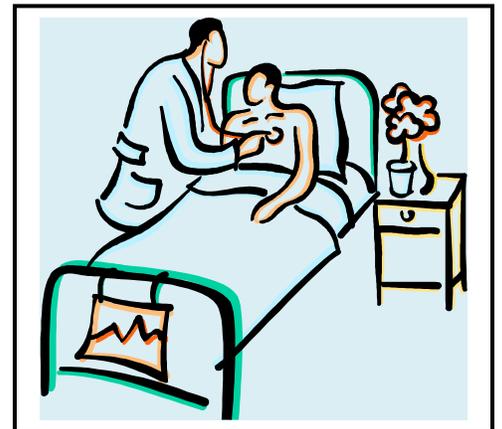
Seizures:

Seizures may occur at the time of aneurysm rupture or sometimes as a result of surgery on certain parts of the brain. Your neurosurgeon may put you on an anti-seizure medication in the hospital. In certain cases your doctor will have you continue this medicine after you go home. If there are no further seizures, the medicine is usually continued for only a short time as determined by your doctor. If you are on anti-seizure medicine, it is important that you take the medicine as ordered. You should consult your doctor if you have any concerns regarding the medication.

Post-Surgery

Common problems after open surgery are:

Incision pain/numbness: The pain is usually localized to the surgical area. It may take several weeks for the incision to heal. After a few weeks, you may experience brief episodes of sharp pain in the incision area as the nerves grow back. This should not be a cause for concern as the pain will go away with time. The incision area can also feel numb which may or may not get better with time.



Hearing Loss: You may notice muffled hearing on the side of the surgery. This problem is due to the operation and will get better with time. However, it may take several weeks for you to notice improvement.

Jaw Pain: This occurs on the operative side of the face when you try to open your mouth to eat or brush your teeth. It is due to the movement of the muscles during surgery. The jaw pain will naturally improve over time. You may be able to speed up your recovery by opening and closing your mouth 4 – 5 times a day and gradually increasing how wide you open it. Notify your surgeon if the pain continues after 6 weeks. Physical therapy may be needed to help you with this problem and aid in healing.

Expected Duration

For those who survive a subarachnoid hemorrhage, recovery is slow. Most people do not recover complete functioning within months of a subarachnoid hemorrhage. Up to 50% of people who survive subarachnoid hemorrhage will have neurological disabilities that last much longer or become permanent.

General Physical Problems

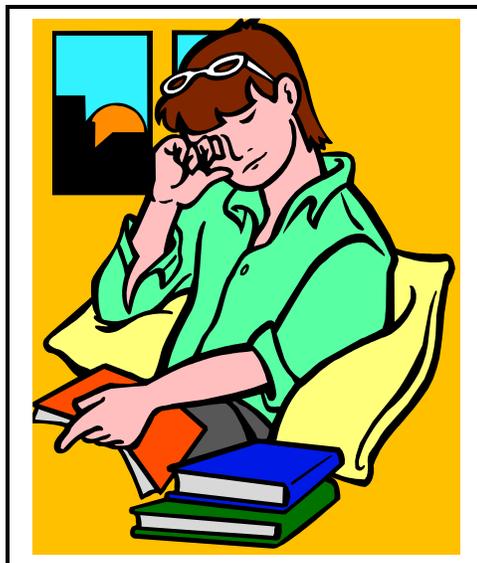
Headaches: Many patients with aneurysms experience headaches. Headaches are usually more of a problem for those who had a hemorrhage. The headaches can vary in intensity from day to day, and last for several weeks or longer. Pain medications may be needed for the first couple of weeks after your treatment. You should switch to over-the-counter pain medications, such as Tylenol, as soon as possible. If headaches are not eased by pain medication – or if the headaches continue even after several weeks, call your doctor. Some patients do have migraine-type headaches which can be treated with special drugs and treatments by a neurologist or pain doctors.

Headaches can be frightening, especially for those people who have had an aneurysm rupture. Keep in mind that the possibility of a treated aneurysm rupturing is almost zero. Headaches due to aneurysm rupture are not only severe but sudden. Call 911 in the rare case that a severe and sudden headache occurs.

Some aneurysm patients have a long history of headaches. These headaches will not be cured by treatment of the aneurysm, as they are not related. The headaches may seem to go away for awhile but unfortunately usually return.

Fatigue: Fatigue is the most common problem in the recovery process. You may feel tired all the time and have no energy or “get up and go”. Normal everyday activities, even simple ones such as taking a shower may wear you out. You may feel more tired after your treatment, leading you to take more naps, only to find that you have trouble sleeping at night.

This is normal. Keep in mind your body has been through a lot. Your body needs to heal. It needs rest and nourishment before it can function well again. Early on you need to just rest and eat well; your job is to help your body heal. As time goes on, gradually increase your activities and the amount of time you spend doing them. It can take months before your activity level returns to where it was before your treatment. Do not get discouraged. Take it one day at a time.



Low Back Pain: Some people have low back pain and/or shooting pain down the back of the leg. If the aneurysm bled, your back pain may be caused by blood in your spinal fluid that is irritating the nerves. This condition will get better with time. Low back pain can also be due to lying bed for many days and lack of activity. This type of back pain usually gets better as you increase your activity level, but may require physical therapy. Gentle stretching or a heating pad may help relieve the pain. Notify your doctor if pain persists.

Constipation: Constipation is a dry, hard stool that is difficult to pass. This is a common condition and may be due to inactivity and/or a diet low in fiber or fluids. The major cause of constipation after aneurysm treatment is the use of narcotic medications. Constipation usually improves with increased activity and decreased use of pain medications. Stool softeners like Colace can be helpful as are mild laxatives such as Metamucil. You should avoid straining or pushing.

Memory

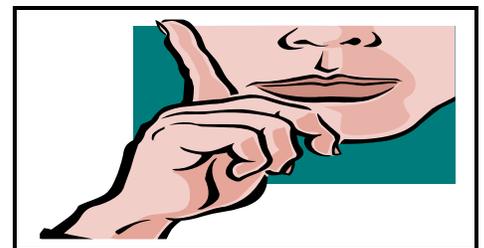
Memory problems after brain aneurysm rupture and/or treatment are a real problem. Survivors might remember events from ten years ago, but cannot seem to remember who called yesterday or where they put their keys. Memory involves many areas of the brain, and if a brain aneurysm or treatment damaged any of those areas, your memory will suffer. Many survivors regain their ability to remember as they continue to heal, while some continue to experience difficulty with short-term memory for years.

Survivors of ruptured aneurysms usually do not remember the event or much of what happened in the hospital and never will. This can be disturbing but is normal. Survivors may ask over and over what happened and it doesn't seem real that they have "lost" this part of their life. Family members may need to explain many times what happened.

Absorbing, storing, and recalling information are some of the problems survivors face after a rupture or treatment of a brain aneurysm. Below are several strategies for coping with these possible problems.

To absorb information more clearly:

- **Link** – associate new information with something old.
- **Simplify** – sensory and language overload are a real issue. Shorten sentences for easier understanding; break up larger pieces of information in order to focus better.



To store information more clearly:

Repeat – immediately after someone says something or you learn something new, repeat it to yourself. Then wait a few minutes, and repeat it again to see if you remember. This sounds funny, but it works!

To recall information more clearly (This is the hardest for most survivors):

- **Organize** – use sticky note pads, a daily planner, a calendar, or an electronic device such as a smartphone to help you remember things. Writing down important information, such as dates, doctor appointments, medication schedules, addresses and phone numbers is very important. Also, be sure to put items such as keys in the same place all the time.



Emotions

Some patients may have some or all of the following emotional experiences:

Depression: This is very common to all survivors, whether you suffered a ruptured aneurysm or were treated for an unruptured aneurysm. Some of it may be chemical, while another part may be physical. The brain has been injured by treatment procedures, either surgical or endovascular or by the hemorrhage itself. Now the brain needs time to heal. See page 14 for more information about depression and how to cope with it during recovery.

Irritability, Frustration, and Confusion: Most survivors experience temporary loss of control over emotions. This can manifest itself in anger, frustration, and lashing out at oneself and others. You may find that you get tearful for no reason at all. A commercial on television may cause you to cry! Confusion about what is happening to you is common, so talk about it. You need to recognize your limits. This will improve throughout your recovery. These symptoms get better with time.

Attention Problems: Most survivors have problems focusing. Their attention span is short. They start something but do not finish it and find their attention drifting from one thing to another.

Some of this may be due to fatigue which is another reason why rest is important. The main reason that this is happening is that the brain is still trying to heal itself and is not yet functioning normally. The brain cannot do too much at one time.

It is important to keep activities short and simple, and to work on one task at a time. Give yourself a certain amount of time to complete a project and do not let yourself be distracted. Break up projects into short mini-projects. Make a daily schedule of activities and stick to it as much as possible. Have a family member help you with projects and help you remember to focus.

Do not try to do too much at one time. For example, do not try to watch TV, talk on the phone, and make dinner at the same time.

Have your family limit visitors. Visitors mean well but can wear you out. If they want to help, suggest they prepare a meal or do shopping for you.

Loneliness: You may feel different or alone as a result of the aneurysm treatment. Talk to others. You are not alone! If you go to the “*Brain Aneurysm Foundation*” website at: www.bafsupport.org, this will give you an opportunity to connect with others experiencing the recovery process.

Depression



Survivors, family members, and caregivers all tend to experience sadness and depression during the rehabilitation process. For the survivor, depression can be caused by the aneurysm itself and also by the life changes that might occur after the aneurysm. While you are struggling with memory problems that are hard to cope with and understand, you may have unrelated hardships or the loss of a job that can further complicate your situation. There may be a change of family roles with husbands giving care for wives or children caring for parents.

A complete understanding of the symptoms of depression and how depression affects the rehabilitation process is vital for you to continue the healing process.

Depression takes on many forms and includes:

- Feelings of sadness on a daily basis
- Guilt and regret about past life events and current problems
- Anger
- Disturbing thoughts:
 - “I’m not worth anything anymore”
 - “I’ve let everyone down”
 - “I’ll never get better”
 - “I’ve done something bad to deserve this”
 - “I’m never going to work again”
- Morbid thoughts:
 - Wishing for death or thinking of suicide
 - Constant worry about the health of others
 - Hopelessness (no hope)
 - Worthlessness

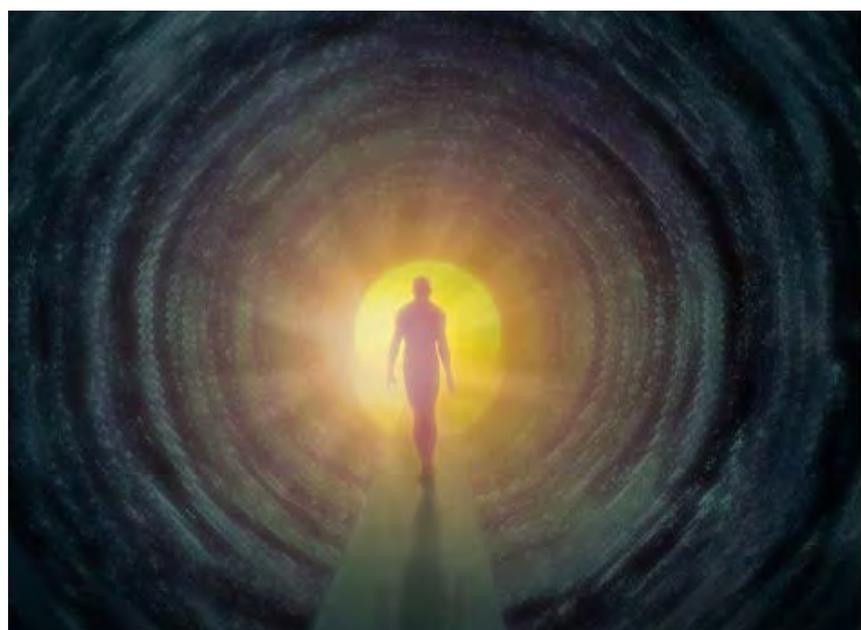
- Lethargy – no motivation, laziness
- Loss of pleasure in activities that were enjoyed in the past
- Poor appetite – weight loss or gain
- Crying more than usual
- Irritability (anger)
- Disturbed sleep
- Poor sex drive

If you experience some of these symptoms, you should visit your doctor who might recommend antidepressant medications as one possible treatment for your depression. In addition, talk therapy with a psychologist or other trained therapist might be recommended.

Negative thoughts that you may have cloud your emotions and serve no purpose. If you feel that things will never get better, your depression may get worse. You must remember to stop being negative and instead apply positive thinking. It takes great strength and practice to overcome negative thoughts, but it can be done with a lot of hard work. Thoughts such as: “Things will get better over time” or “we can deal with the problems that are seen in the rehabilitation process” will help you and your caregivers complete this hard journey.

Words of Wisdom:

- **Be patient with yourself and accept your changing feelings**
 - **Understand that you cannot control your emotions**
- **Practice positive thinking and you will eventually find the light at the end of your tunnel**



Prevention

It is almost impossible to prevent subarachnoid hemorrhage caused by an aneurysm or AVM. These blood vessel abnormalities usually do not cause any symptoms before the hemorrhage occurs. Smoking has been shown to increase the risk of forming an aneurysm, so avoiding smoking may prevent some cases of hemorrhagic stroke.

Some people have proposed screening tests, such as MRI angiography, that would identify aneurysms before they cause a problem. However, this idea has been impractical for most people, because surgery to remove an aneurysm can leave you with decreased function after your recovery. For most people, this is a risk that is not worth taking, since most aneurysms never cause serious bleeding.

Screening and surgery are not recommended for people who have a single close relative who has a brain aneurysm or a subarachnoid hemorrhage. Screening and surgery may make sense for people who have *two or more* close relatives who have had bleeding, since this family is at an especially high risk. Because aneurysm screening is questionable, you should consider the risks of surgery carefully with your doctor before you ask for a screening test.

Rehab Therapy

Occupational and physical therapy will likely be needed if neurological problems have occurred. The therapists are professionals who help the person improve daily function and regain strength after brain injury. Commonly, hospitalization is followed by a brief stay at a rehabilitation center, where additional intensive therapy may be provided. The goal of rehabilitation is to help the patient recover as much physical and speaking function as possible.



Risk Factors for Aneurysm

Risk factors for aneurysm include:

- * hypertension
- * alcohol abuse
- * presence of an unruptured aneurysm
- * history of 1st degree family member with an aneurysm (especially if more than 2 were affected)
- * severe and ongoing high blood pressure between the ages of 36 and 60 which increases your risk of an aneurysm
- * smoking (increases risk times 8)
- * use of stimulant drugs such as cocaine
- * history of previous aneurysm

Prevention of Subarachnoid Hemorrhage

It is estimated that up to one in 15 people in the United States will develop a brain aneurysm during their lifetime. The best way to prevent an aneurysm is to avoid the risk factors that increase the chances of developing one. To do this, a person can:

- * Take all medications as prescribed by your doctor
- * Stop smoking and drinking
- * Control high blood pressure
- * Control high cholesterol
- * Get regular physical exercise
- * Eating a diet rich in vegetables can reduce your risk of subarachnoid hemorrhage

