

## Section Editors

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# Subarachnoid hemorrhage

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Subarachnoid hemorrhage (SAH) can result from the rupture of an intracranial aneurysm—a weakened, dilated area of a blood vessel in the brain that is prone to burst. SAH can be devastating. Approximately 1 in 6 patients dies at the time of the bleeding. Those who initially survive can die after early rebleeding or have major complications. The complications of SAH include strokes from delayed spasm of blood vessels in the brain even after the aneurysm that caused the hemorrhage is treated. Most of the research on SAH has been focused on this early phase. Less is known about what happens longer term to those patients who survive SAH.

Patients who have had an SAH—and their families—often have many questions when they leave the hospital. How will I recover? What is the risk that this could happen again? How can I prevent this from happening again? Am I at risk of other diseases? Those are some of the most common questions asked.

Good recovery is possible, although some patients will be left with physical limitations or problems with their thinking. In those cases, long periods of rehabilitation are important to provide the best chances of recovery. SAH can happen to the same person again. Because of this, patients need to continue to see their doctor. Follow-up is important to make sure that the aneurysm is still fully treated and to make sure that no other aneurysms have formed, or to have them treated if present. Other factors are very important to prevent a repeat SAH. These include good control of the blood pressure and quitting smoking. High blood pressure and smoking are both known risk factors for the formation and rupture of intracranial aneurysms.

**WHAT DID THE AUTHORS STUDY?** In their article, Korja et al.<sup>1</sup> describe how patients are doing a year after SAH. They help us answer what is the future risk of death not only from a repeat bleeding but also from other diseases in patients who survive.

This study was done in Finland. Because that country has an advanced national health care system, the researchers had reliable health data for the Finnish people over long periods of time. The study used information from the National FINRISK Study, which collected data from large proportions of the populations of entire regions of the country through surveys done between 1972 and 2007. The researchers had

information from more than 64,000 Finnish residents and could see which of them had died and what they died of over the period of the study by using complete national death registries. Within the National FINRISK Study, the researchers identified 437 cases of SAH. Of these, many did not survive the first year. Eighteen percent died before ever being hospitalized, 26.5% died during the first 30 days after the bleeding, and 5.6% died before the end of the first year. The remaining 233 patients who had survived for more than 1 year became the main focus of this study.

More than one-third of these 233 patients died over the follow-up period of approximately 8 and 9 years on average. This is a high rate of death because the average age of these patients was only 57.5 years. More important, this rate of death was much higher than in a matched group of 2,330 patients from the same Finnish registry who were of similar age and sex but had not had an SAH. In what is considered the “matched comparison group,” only 21.7% died over a follow-up time that was even longer than the follow-up period for the SAH survivors. The results were convincing: 1-year SAH survivors had almost twice the risk of dying over a similar follow-up period than the control patients of comparable age and sex.

The researchers also looked at the effect of risk factors for vascular disease on the risk of dying over the follow-up period. The vascular risk factors examined were high blood pressure, smoking, and high cholesterol. If a patient had all 3 of these risk factors, the risk of death was double in both the control group and especially the SAH group. This is very important because high blood pressure and smoking were more common in the SAH group than the general population.

Finally, when looking at the causes of death, the researchers saw that strokes fully accounted for the increased deaths among survivors of SAH (see the article’s figure 2 and legend). (These were strokes caused by blockage of blood flow to the brain [“ischemic” strokes], but there were also more fatal bleeding strokes.)

**WHY IS THIS STUDY IMPORTANT?** This study shows that patients who survive an SAH have a higher risk of dying than the general population. It also shows that most of this risk is related to having ischemic strokes, rather than repeat bleeding, and demonstrates

that vascular risk factors—high blood pressure, smoking, and high cholesterol—increase the risk of death over time in all people, but especially in survivors of SAH. Put together, this study provides valuable information indicating that reducing vascular risk factors should be a key priority in survivors of SAH. Stopping smoking and strict control of the blood pressure and cholesterol levels are needed to prevent additional brain disease. This advice is not new and is given to all people, but before this study we did not know how important this advice is to survivors of SAH. For patients who survived an SAH, and their families, the message from this study is loud and clear: smoking, high blood pressure, and high cholesterol will make you die before your time. You must stop smoking and work with your doctor to make sure that your blood pressure and cholesterol levels are not

high. Doctors must closely follow and treat survivors of SAH to make sure this risk is reduced.

**WHAT DO WE STILL NEED TO LEARN?** Future studies need to be done to determine the most effective ways to decrease the risk of death in patients with a history of SAH, including the best ways to reduce risk of further problems. Help is available for people who need it to make the difficult changes in lifestyle, such as quitting smoking. These changes will likely have long-term benefits.

#### REFERENCE

1. Korja M, Silventoinen K, Laatikainen T, Jousilahti P, Salomaa V, Kaprio J. Cause-specific mortality of 1-year survivors of subarachnoid hemorrhage. *Neurology* 2013; 80:481–486.

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# About subarachnoid hemorrhage

## WHAT IS SUBARACHNOID HEMORRHAGE?

Subarachnoid hemorrhage (SAH) is a bleeding between the brain and its surrounding membrane, which is called the arachnoid. The blood goes into this area, which is called the subarachnoid space.

**WHAT CAUSES AN SAH?** Although SAH may result from head trauma or be caused by rupture of a tangle of abnormal blood vessels (called an “arteriovenous malformation” or AVM), its main cause is ruptured intracranial aneurysms. Intracranial aneurysms are out-pouchings of brain blood vessels. These are typically located where these blood vessels divide into branches. Aneurysms tend to have more fragile walls than normal vessels, which puts them at risk of rupture. It is likely that most aneurysms are not present at birth, but instead are formed over the course of life.

**WHO IS AT RISK OF AN SAH?** Patients with intracranial aneurysms are at risk of SAH. Intracranial aneurysms are fairly common in the general population (they can be present in approximately 1% of all people), but most of these aneurysms do not rupture. Smaller aneurysms (less than 7 mm) that are in the blood vessels near the front of the brain carry a very small risk of rupture. However, larger aneurysms, those located near the back of the brain, and those that get larger over time (among other features) can have a high risk of rupture and need to be treated. The risk is also higher in patients with a previous SAH, family history of SAH in a close relative, high blood pressure, smoking, and binge drinking.

**CAN SAH BE PREVENTED?** Treatment of high-risk unruptured aneurysms, treatment of high blood pressure, quitting smoking, and avoidance of excessive alcohol use can all reduce the risk of SAH.

**WHAT ARE THE SYMPTOMS OF SAH?** Because SAH is caused by bleeding from arteries, the type of blood vessels that bring blood under pressure to all organs, their rupture produces a sudden and violent bleeding. This causes a very rapid rise in the pressure inside of the head, which leads to a very sudden and excruciating headache. This headache is often referred to as a “thunderclap headache” because of its extremely fast and severe onset. Patients may also lose consciousness (“pass out”) and, in the worst cases, death can be

instantaneous. Some patients may also develop double vision, blurred vision, or weakness on one side of the body. Within hours of the initial bleeding, patients can experience further symptoms. These can happen because of a second bleeding, which is very dangerous and often fatal. Additional symptoms can also happen because of blockage of flow of spinal fluid through the brain, a condition called “hydrocephalus.” If brain blood vessels are exposed to blood outside them, a few days later they can begin to constrict too much and this is known as “delayed vasospasm.” When severe, vasospasm can cause strokes by blocking blood flow to brain tissue.

**HOW IS SAH TREATED?** The treatment of SAH is complex and requires the expertise of specialized doctors and nurses working in teams. Patients with this condition need the close attention given in the intensive care unit, ideally one dedicated to the care of patients with critical brain disease. Patients with SAH may need a machine to help them breathe, drugs given by IV to regulate the blood pressure, and drains placed in the brain or the lower back to reduce pressure in the brain. They all need to be very strictly monitored to ensure the prompt detection and timely treatment of any complications. The ruptured aneurysm needs to be identified and treated. This is most often done using a test called a cerebral angiogram. With this test, a dye is injected into the blood vessels of the brain to examine them in detail. Once the aneurysm causing the bleeding is detected, it must be treated. Treatment is done in 2 ways. The first is by open surgery. The second is by using a device threaded through the blood vessels to the site of the aneurysm. This is called “endovascular” (through the blood vessel) treatment. Open surgery allows treatment of the aneurysm by clipping its base, thus stopping the entry of blood into it. With endovascular treatment, the aneurysm is filled with small metallic coils that close off the aneurysm. Both treatments are highly effective to prevent future bleeding when performed by experienced doctors. After treatment of the aneurysm, most patients need to remain in the intensive care unit for several more days. During that time, they are monitored for the possibility of developing vasospasm. If vasospasm develops and is severe enough to cause symptoms from reduced blood flow, patients must be treated. This treatment is often with medications to increase their blood pressure

to keep blood flowing past the spasm. In the most severe cases, an endovascular treatment to dilate the vessels may be needed.

#### **WHAT ARE THE CONSEQUENCES OF AN SAH?**

SAH is a very serious disease. One in 6 patients may die at the time of the bleeding even before reaching a hospital; another fifth may die during hospitalization. Survivors may have impaired physical and mental function. Yet, with excellent care, complete recovery is possible.

#### **HOW CAN A REPEAT SAH BE AVOIDED?**

All patients who survive an SAH need to follow closely with their doctor after leaving the hospital. This follow-up should include a repeat brain angiogram to make sure that the previously ruptured aneurysm continues to be fully treated (that is, there is no reentry of blood into it). If other (unruptured) aneurysms are

present, they should be considered for treatment. Control of high blood pressure and quitting smoking are also very important to prevent the formation of new aneurysms and their subsequent rupture.

#### **FOR MORE INFORMATION**

AAN Patients and Caregivers site  
<http://patients.aan.com/golhome>

American Stroke Association  
<http://www.strokeassociation.org>

Brain Aneurysm Foundation  
[office@bafound.org](mailto:office@bafound.org)  
<http://www.bafound.org>

Brain Attack Coalition  
<http://www.stroke-site.org>

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