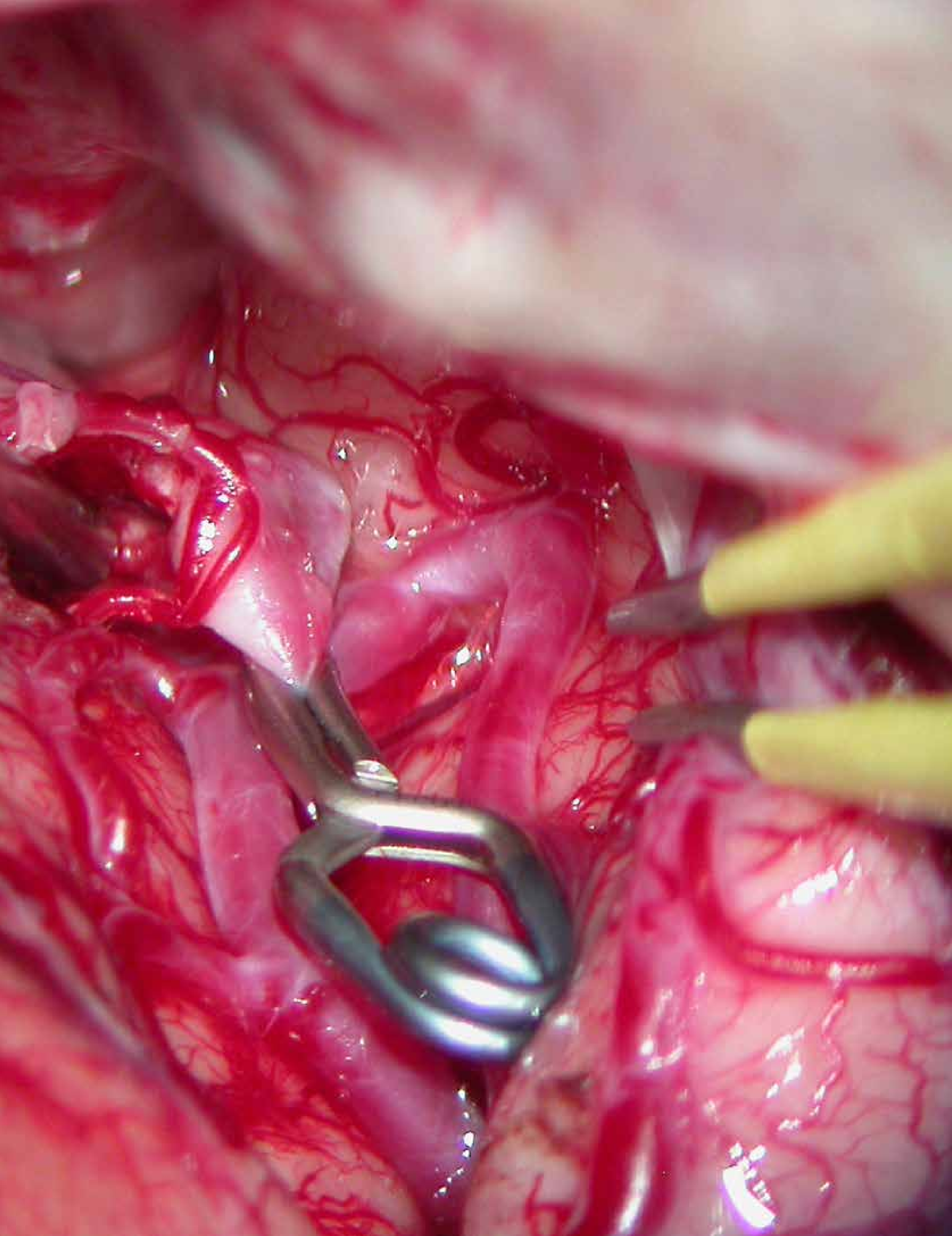

Surgical Clipping for a Cerebral Aneurysm

Shontell Reed-Hatcher, CST

When cerebral aneurysms rupture, they can be an unforgiving entity. Cerebral aneurysms usually rupture suddenly – with little or no warning – and can be fatal or severely disabling. Even though medical practitioners long have been aware of aneurysms, detection and treatment, and despite improvements to technologies, the overall outcome from a ruptured cerebral aneurysm has remained bleak. Fewer than 50% of patients treated for a ruptured aneurysm survive six months. A large percentage of those patients never return to independent living.[7]

Author's note: As a Certified Surgical Technologist, I have more than 16 years of experience working with a team of highly qualified surgical professionals in the performance of cerebral aneurysm or aneurysmal subarachnoid hemorrhage (aSAH) clippings. This life-saving surgical procedure requires the expert skill of each team member, including the radiologist, surgeon, nurse, anesthesiologist and surgical technologist. In my role as a surgical technologist, it is imperative that I be knowledgeable of the condition being treated to ensure my performance contributes to the success of the surgical procedure.

LEARNING OBJECTIVES

- ▲ Explain the three types of cerebral aneurysms
- ▲ Compare and contrast the role of the four common diagnostics methods used to help determine the best form of treatment for cerebral aneurysms
- ▲ Describe the surgical procedure that is used to clip the aneurysm before rupture
- ▲ Recall the signs and symptoms of a cerebral aneurysm before rupture
- ▲ Review the prognosis for patients that have surgery to treat a cerebral aneurysm

Cerebral aneurysm is the common term for an intracranial, intracerebral or brain aneurysm. The indication of a cerebral aneurysm is the thin or weakened area on a blood vessel in the brain that eventually fills with blood. The subsequent ballooning or bulging of the blood vessel places pressure on nerves or the surrounding tissue, which may cause the blood vessel to rupture or burst. The overflow of the blood fills around the brain tissue and results in hemorrhaging. Although locations of aneurysms may vary, many patients experience them along a loop of arteries running between the underside of the brain and the base of the skull.[5]

Cerebral aneurysms occur in as many as 1 in 20 individuals throughout the world. Remarkably, most aneurysms are never detected, and most individuals with aneurysms remain asymptomatic throughout their lives. However, in the United States each year, there are more than 30,000 individuals who suffer complications from cerebral aneurysms, with thousands more worldwide.[1]

CAUSES OF CEREBRAL ANEURYSMS

A number of conditions might contribute to the cause of cerebral aneurysms. Individuals can have a congenital predisposition to aneurysms that might result from an innate abnormality in artery walls leading to the brain.[6] Additionally, cerebral aneurysms are found to be more common in people with genetic diseases, such as connective tissue disorders and polycystic kidney disease. Certain circulatory disorders, such as tangles of arteries and veins that disrupt blood flow to the brain, might contribute to the formation of cerebral aneurysms. Researchers have found that cancer-related aneurysms often are associated with tumors of the head and neck. Additional causes of cerebral aneurysms can include trauma or injury to the head, high blood pressure, infection, tumors, atherosclerosis and other vascular diseases. Cigarette smoking and drug abuse, particularly the habitual use of cocaine, have proven to cause an inflammation of blood vessels in the brain and eventually have led to the development of cerebral aneurysms. Some research has tested whether or not use of oral contraceptives may increase the risk of developing an aneurysm, however, more research needs to be conducted to further evaluate this hypothesis.[7]

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CLASSIFICATION OF ANEURYSMS

Cerebral aneurysms are classified into three distinct types.[2] A saccular aneurysm is a rounded or pouch-like sac of blood attached by a neck or stem to an artery or a branch of a blood vessel. This type often is referred to as a berry aneurysm for its resemblance to a berry hanging from a vine. It is the most common form of a cerebral aneurysm and typically is found on arteries at the base of the brain. This type is most commonly found in adults. The second type is a lateral aneurysm that appears as a bulge on one wall of the blood vessel. The third type is termed a fusiform aneurysm, which is formed by widening along all walls of the vessel. Aneurysms are classified by size from small to giant. Small aneurysms are less than 11 millimeters in diameter; large aneurysms are 11 to 25 millimeters, while giant aneurysms are greater than 25 millimeters in diameter.

SIGNS AND SYMPTOMS

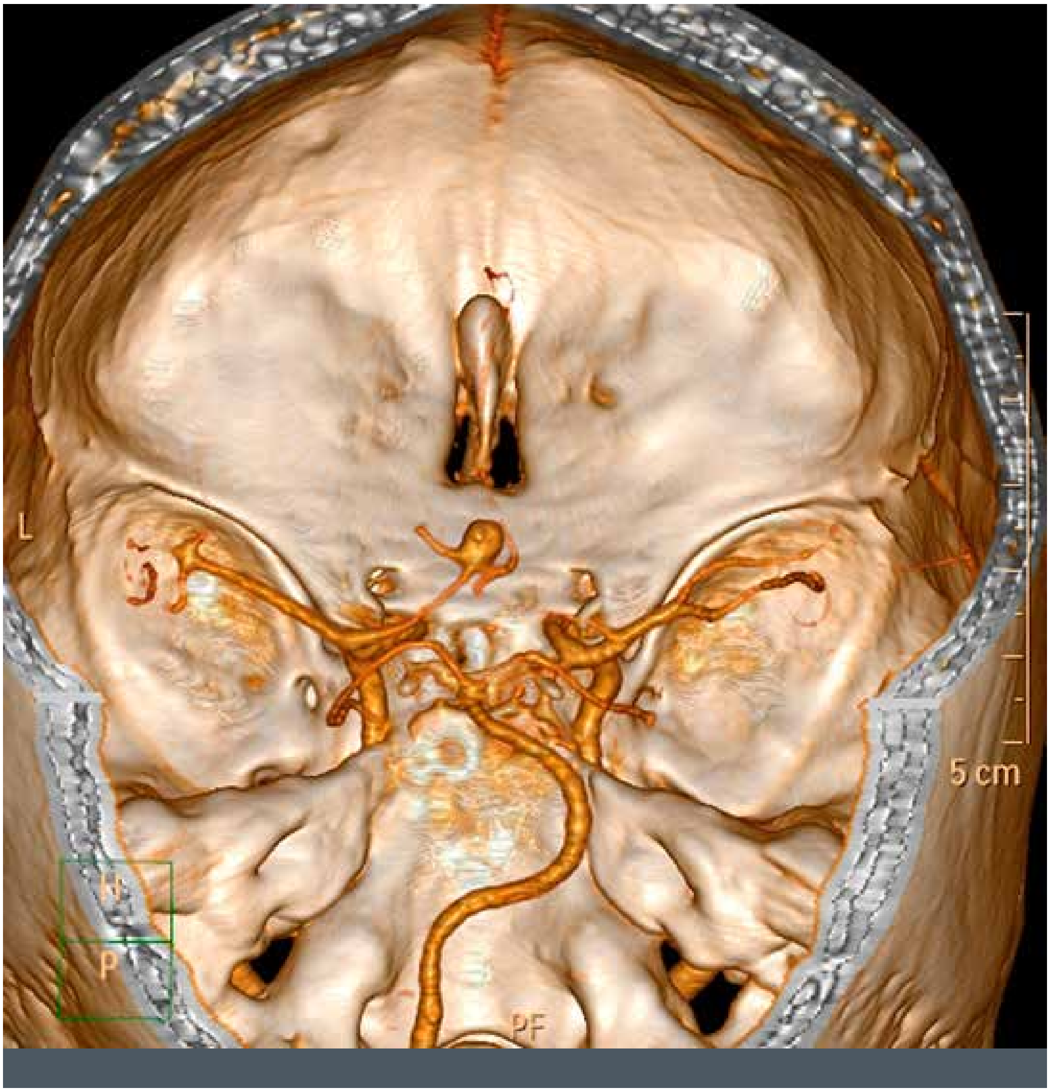
Cerebral aneurysms most often do not exhibit signs or symptoms until they become large or burst. Small, unchanging aneurysms can occur in the brain and never produce symptoms. If an aneurysm continues to grow, it begins to press on tissues and nerves. Ensuing symptoms of this growth may include pain above and behind the eye, numbness, weakness or paralysis on one side of the face, dilated pupils and vision changes. Once an aneurysm hemorrhages, individuals usually experience a sudden and severe headache. It differs in severity and intensity from any other headache an individual has previously experienced, with most saying it is the worst headache they have ever had. Other symptoms include double vision, nausea, vomiting, stiff neck and/or loss of consciousness.[2]

Signs that a cerebral aneurysm has ruptured or burst include nausea and vomiting accompanied by a severe headache, a drooping eyelid, sensitivity to light and changes in the mental status or level of awareness of an affected individual. At times, some individuals have experienced seizures, have become unconscious or entered into a prolonged coma.[3]

DIAGNOSIS

In the article "Aneurysm Patient Receives Second Chance at Life," a patient was at the hospital with a painful headache. The medical team was going to discharge her with pain medication, but she insisted on a computed tomography (CT) scan. The doctor told her she was fortunate to insist on the scan because if she hadn't she most likely would have gone home and died.[8] Unfortunately, most cerebral aneurysms are overlooked until they either rupture or are detected by brain imaging obtained for other conditions. If imaging reveals a subarachnoid hemorrhage, more testing is conducted to confirm the diagnosis of an aneurysm.

According to the National Institute of Neurological Disorders and Stroke (2013), there are several diagnostic methods to help determine the best form of treatment. Four of the most common methods are the angiogram, the CT scan, magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA). The angiography dye test, or angiogram, is used to analyze arteries or veins. It can detect the degree of narrowing or obstruction of a blood vessel in the brain, head or neck. An angiogram also can identify changes in an artery or vein, detecting weak spots such as aneurysms. The CT scan is often the first diagnostic procedure ordered by a physician following a suspected rupture. It is a quick, painless, noninvasive diagnostic tool that reveals the presence of an aneurysm. If an aneurysm has ruptured, a CT scan will determine whether blood has leaked into the brain. The MRI uses computer-generated radio waves and a powerful magnetic field to produce detailed images of the brain.[7]



TREATMENT

As previously mentioned, unruptured aneurysms can go unnoticed throughout a person's lifetime; a ruptured aneurysm, however, can be fatal or could lead to a hemorrhagic stroke, vasospasm (the leading cause of disability or death following a ruptured aneurysm), hydrocephalus, coma, or short-term and/or permanent brain damage. If it is determined that an aneurysm requires surgical invention, there are two options. The first is endovascular coiling of an aneurysm, which is performed as an extension of an angiogram. The second intervention, and the one that will be examined in this article, is open surgical clipping of the aneurysm.

PRE-OP

A routine preoperative checklist includes: history and physical, labs HCG (females), EKG and placement of IV. Anesthesia, surgical and blood consents are verified by the anesthesiologist and a registered nurse. The patient and their family are then asked if they have more questions and concerns before being transported to the operating room.

SURGICAL PROCEDURE

After the patient is transported to the operating room, the first time out is performed to confirm the surgical site. Then, the patient is placed on the operating table in the supine position to allow administration of general anesthesia. Following intubation and stabilization of the patient a Foley catheter, an arterial line, and supplemental intravenous lines are inserted and any additional monitoring equipment is applied. The patient is repositioned in either a right/left lateral or sitting position according to the location of the aneurysm and the operating table may be turned 90 degrees to allow more space near the surgical site.

The patient's whole head is typically shaved, but for some patients (especially female), portions of the hair may be spared by securing segments of hair away from the surgical site using elastic bands to create ponytails. In preparation for application of the Mayfield head holder, the areas where the pins are expected to penetrate the scalp may be localized using 1% lidocaine with epinephrine. The head of the table is removed and the base clamp is inserted. The skull clamp is affixed to the patient's scalp and connected to the base clamp. The intended incision site is prepped using an antimicrobial solution and exposed with surgical drapes. Frequently, a Mayfield table placed over the patient's body is used instead of a Mayo stand. The remainder of the furniture and equipment needed for the procedure is positioned around the patient. Cords for the bipolar and monopolar electrosurgical units, tubing for suction and irrigation, power hoses, and the light handles are placed and connected. Use of a microscope, ultrasound equipment, and a neuro Doppler should also be considered.

According to facility policy, a second timeout may be performed immediately prior to initiation of the incision. The incision is made using a #10 blade and Raney scalp clips are placed along the wound edges to provide hemostasis. Bleeding is controlled electrosurgically and a periosteal elevator is used to separate and elevate the periosteal membranous layer from bone. The soft tissue flap is wrapped in moistened lap pad, folded away for the surgical site, and secured by the method of surgeon preference. Burr holes are created with the use of a cranial perforator and connected using a cranioblade. Bone wax may be applied to the exposed bone edges to reduce bleeding. The bone flap is removed, kept moist, and placed in a safe location on the back table for reimplantation at the end of the procedure. Neurosurgical patties may be placed around the edges of the bone to protect the dura. Two 4-0 braided nylon sutures may be placed in the dura at the intended incision site to allow tenting of the dura away from the brain. An incision into the dura is made and the brain tissue is dissected to expose the aneurysm. As the dissection becomes more delicate, it may be necessary to use the microscope to enhance the view of the surgical field. Once the surgeon visualizes the aneurysm, he or she may make a selection of aneurysm clips to be loaded for possible use. The aneurysm is freed from the surrounding tissue using a ball dissector and other microsurgical instruments. Meticulous hemostatis is maintained throughout the procedure. The chosen clip is applied to the aneurysm and the surgeon may use the Doppler to verify that blood flow to the aneurysm has been disrupted. Another method that can be used to verify disruption of blood flow to the aneurysm is systemic injection of a dye, such as indocyanine green. Movement of the dye through the vasculature is observed with the use of the microscope. When the surgeon is satisfied with placement of the aneurysm clip, the wound is irrigated, a drain placed if necessary, the dura is sutured with a 4-0 braided nylon suture on a small needle, and the bone flap is reimplanted and secured using plates and screws, suture, or wire. The surgical technologist must be sure to initiate closing counts at the appropriate times. The galea aponeurotica is closed with 0 or 2-0 polyglactin 910; use of control release needles may be useful. The skin is closed with staples, or in the case of a female with a partially shaved scalp 3-0 polyglactin 910 suture with a small cutting needle may be substituted for the staples, the dressings are applied, and the patient is transferred to the intensive care unit.

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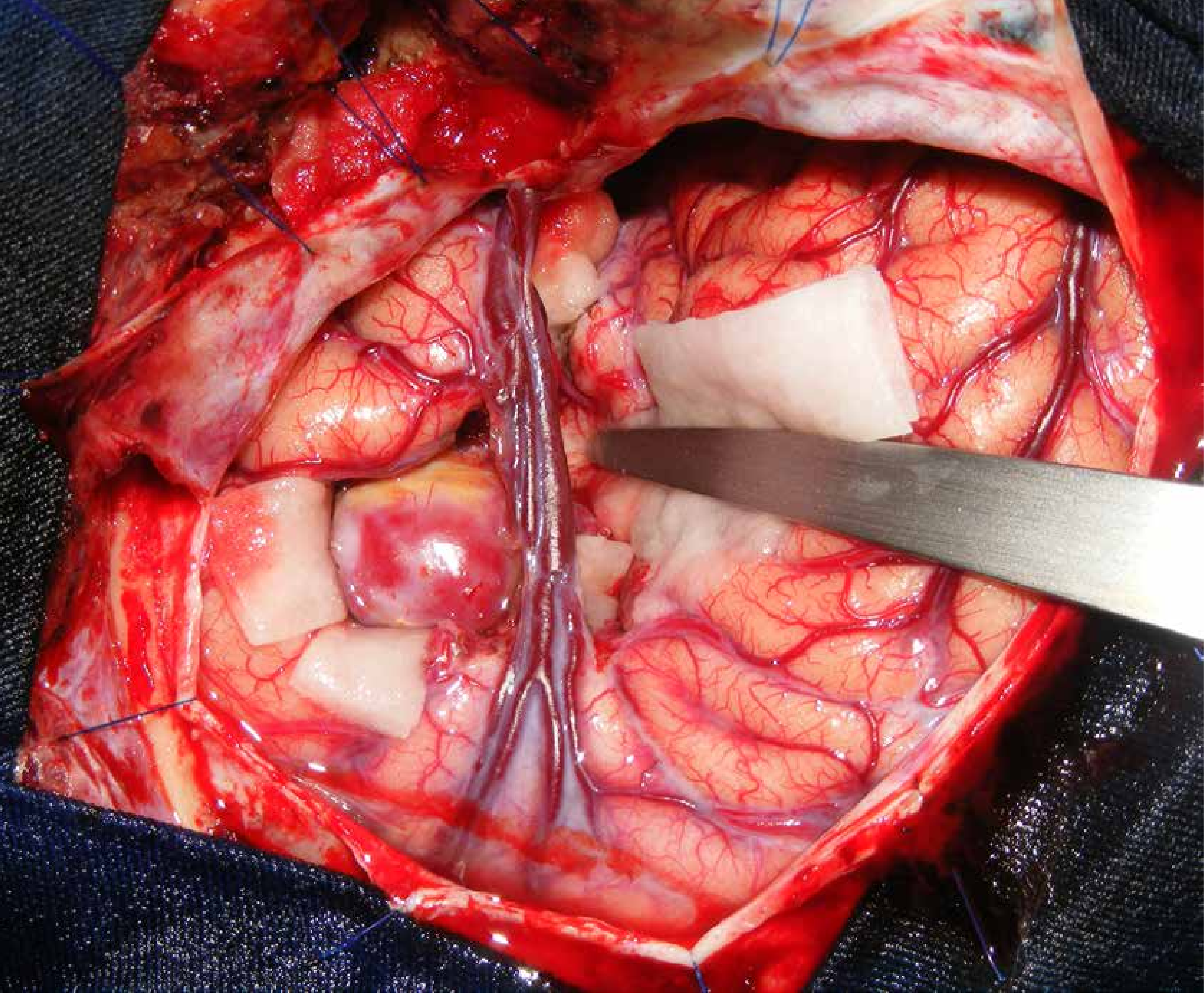

POST-OPERATIVE RECOVERY

Recovery depends on the individual and can take a couple of weeks to several months. Clinical studies suggest that in the first six months after treatment, patients who have been treated with endovascular coiling have less disability than those with surgical clipping. Beyond six months after treatment, the amount of disability is about the same. Long-term results of coiling procedures are uncertain, pending more research to understand the long-term effects, as some aneurysms can recur after coiling.[7]

PROGNOSIS

The prognosis for individuals who experience a ruptured aneurysm is dependent on their age and general health, other pre-existing neurological conditions, location of the aneurysm, the extent of bleeding (and re-bleeding) and the time that elapses between the rupture and receiving medical attention. Research indicates that about 40 percent of those whose aneurysm has ruptured do not survive the first 24 hours, and as many as 25 percent more die from complications within 6 months. Individuals who experience subarachnoid hemorrhaging may have permanent neurological damage, while others may recover with little or no neurological deficit. There can be delayed complications from a ruptured aneurysm including hydrocephalus and vasospasm. Individuals who are diagnosed and treated prior to the rupture of an aneurysm require less rehabilitative therapy and recover quicker than patients whose aneurysm has ruptured.[7]

CONTINUED RESEARCH

The primary source of research on disorders of the brain is the National Institute of Neurological Disorders and Stroke (NINDS), a component of the National Institutes of Health (NIH) within the US Department of Health and Human Services. Part of the NINDS' focus is conducting research on cerebral aneurysms. In one of its studies, 4,000 patients from 61 sites across the United States, Canada and Europe participated. Findings suggested that the risk of rupture for the majority of those experiencing a very small aneurysms was low. The results provide guidance to individuals and physicians facing the difficult decision about whether or not to treat an aneurysm surgically.

In a collaborative research effort being conducted in the United States, Canada, Australia and New Zealand, scientists are seeking methods for identifying possible genes that may increase the risk of the aneurysm development. This study involves 475 families with multiple affected family members. Researchers hope to determine the effect of environmental factors, such as cigarette smoking and high blood pressure, on those genes. The relationship between intracranial and aortic aneurysms has been recognized but poorly quantified. Some data indicate that individuals and families harboring one type of aneurysm might be at increased risk for other types hence the need for more research regarding chromosomes, chromosomal regions, and the identification of aneurysm-related genes.

There are indications that aspirin may lessen inflammation in cerebral aneurysms and reduce their incidence of rupture. Scientists using enhanced MRIs to monitor the signal generated by macrophages hope to determine if daily aspirin intake for three months will reduce the MRI signal changes generated by macrophages in the aneurysm wall. In addition, research has determined that rates of intracranial aneurysms and subarachnoid hemorrhage are significantly higher in women after menopause than in men. Estrogen replacement therapy helps reduce the risk for subarachnoid hemorrhage in post-menopausal women. Researchers continue to investigate the role of estrogen in the pathophysiology of intracranial aneurysms. Other research projects include studies of the effectiveness of microsurgical clipping and endovascular surgery to treat various types of ruptured and unruptured aneurysms, the use of various types of coils to block the flow of blood into the aneurysm, and the aspects of blood flow (hemodynamics), such as blood flow velocity and blood pressure, in initiating cerebral aneurysms.[7]

ABOUT THE AUTHOR

Shontell Reed-Hatcher, CST, has been a Certified Surgical Technologist for more than 14 years. She is currently employed at the University of Maryland Medical Center and a member of the neurology and liver transplant team. Aneurysm clippings has been one of her favorite surgeries to scrub. She wishes to thank Dr Enslin F Aldrich, MD, and Dr J Marc Simard MD, PhD, for their continued support, encouragement and input for this article. She thanks chief resident Dr Adam Polifka, for lending her his neurology books to use as resource for this article, and chief resident Dr Gary Swartzbauer for his input.

Shontell enjoys her career, working with these doctors and helping with life-saving procedures. Lastly, she sends love and appreciation to her husband Ben, her three children, Imani (19), Benjamin (9) and Isaiah (8) and to her all her family and friends for all their guidance and support.

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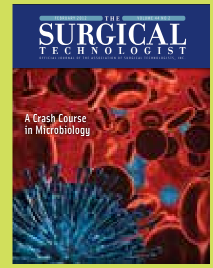

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