



California Pacific
Medical Center

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Cerebral Aneurysm: State-of-the-Art Neurosurgical Techniques

Coil Embolization and Surgical Clipping

NEUROSCIENCE INSTITUTE NEUROSURGERY SERVICES

At California Pacific Medical Center, neurosurgery and neuroradiology specialists bring new and advanced surgical options to the physicians we serve and the patients they care for. Working collaboratively, our neuroscience experts provide comprehensive patient care using leading-edge technology for treating the most complex cerebrovascular conditions. Through this procedure profile, our physicians illustrate minimally invasive surgical techniques as well as open craniotomy techniques for treating ruptured and intact cerebral aneurysms.

At California Pacific Medical Center we go beyond medicine to treat the whole person, not just the illness. Our promise to our patients is to deliver the highest quality expert care with kindness and compassion. We believe medicine can transform a body, but going beyond medicine can transform a life.

For patient referrals, call
1-888-637-2762

Beyond Medicine.



Jeffrey E. Thomas, M.D., FACS, Neurosurgical Cerebrovascular Director and Medical Director, Interventional Neuroradiology, performing cerebral aneurysm surgery.

A CEREBRAL ANEURYSM OCCURS WHEN A WEAK SPOT IN A BRAIN BLOOD VESSEL BALLOONS. Engorged with blood, the aneurysm either causes pressure on surrounding brain tissue or it ruptures. Aneurysms develop for a variety of reasons, including age, genetic predisposition, and less commonly from injury or infection. Saccular, or “berry,” aneurysms—resembling a small sac—are the most common type and often require intervention.

Often an aneurysm can go undiagnosed for long periods of time as they rarely produce symptoms, unless they rupture. When aneurysms enlarge or burst most people develop a migraine-like headache, commonly described as “the worst headache of my life.” Signs that an aneurysm is present include pain above and behind the eye, vision problems, weakness, and dilated pupils.

Ruptured brain aneurysms cause

blood to seep into the space around the brain (subarachnoid hemorrhage) or into the brain (intracerebral hemorrhage). The symptoms of a ruptured aneurysm can include sudden onset of severe headache, nausea and vomiting, stiff neck, sensitivity to light, loss of sensation, seizures, and loss of consciousness.

Annually, approximately 30,000 Americans experience a ruptured brain aneurysm and roughly only one in five aneurysms are diagnosed prior to rupture. Among patients with rupture, about 40–50% will survive, 20% without lingering physical deficits. Screening for cerebral aneurysm is not standard annual-physical-examination protocol. However, since cerebral aneurysm carries a genetic predisposition, it is highly recommended that cerebral aneurysm patients’ close family members obtain diagnostic screening. Computed tomographic angiography, magnetic resonance angiography, or

cerebral angiograms are effective cerebral aneurysm diagnostic screening tools.

When an aneurysm ruptures, often blood invades the circulation of cerebrospinal fluid, causing increased pressure in the brain. This blood irritates, damages, or destroys brain cells. Occasionally aneurysms heal over without intervention, but in most cases, without intervention ruptured aneurysms cause paralysis, coma, or death.

Why use surgical clipping or coil embolization to treat aneurysms?

Patients with an intact brain aneurysm are constantly at risk for rupture. Depending on the characteristics of the aneurysm, highly trained neurosurgeons decide which technique will best serve the patient. Aneurysms can be successfully treated pre- or post-rupture using clipping or coiling. All patients presenting with a ruptured aneurysm are treated on an emergency basis.

What is coil embolization?

Coil embolization, commonly referred to as coiling, is a minimally-invasive surgical procedure. Accessing the brain with an incision the size of an eyelash, the aneurysm is repaired via a blood vessel in the groin. Using state-of-the-art technology, coiling is performed in the hospital's interventional radiology suite. With a team of highly trained neurosurgical professionals, neurosurgeons and/or interventional neuroradiologists insert a catheter into a femoral artery, guiding it to the brain using real-time X-ray visualization and high-speed radiographic filming techniques. Once the aneurysm is located, a micro-catheter is inserted through the larger catheter and guided to the aneurysm for coiling. The platinum coils, flexible enough to conform to the aneurysm shape, are threaded into the aneurysm, reducing or blocking blood flow feeding the aneurysm.

What is surgical clipping?

Surgical clipping isolates the aneurysm from normal blood circulation, preventing rupture or enlargement, and stops bleeding. Clipping, performed via craniotomy, is used to treat pre- and post-ruptured aneurysms. Prior to surgery, cerebral angiography images identify the exact aneurysm location. Once the brain is exposed, the neurosurgeon locates the aneurysm with the aid of a surgical microscope and places a tiny titanium clip at the aneurysm neck to block the blood flow. To ensure that the aneurysm is adequately clipped, the neurosurgeon may elect to perform an intra-operative angiogram after the clip placement to monitor blood circulation in the brain. This is routinely performed at California Pacific.

What factors determine intervention type?

Based on several factors and clinical judgment, the neurosurgeon recommends the procedure that is safest and most effective for each individual.

FACTOR ONE: PHYSICAL CONDITION

Older or sicker patients have better outcomes from coil embolization. They may not be strong enough for the clipping procedure.

FACTOR TWO: ANEURYSM SHAPE

It is easier to coil a saccular aneurysm with a smaller neck than an aneurysm with a wide neck. Similarly, it may be arduous to coil an aneurysm that does not have a clearly defined opening.

FACTOR THREE: ANEURYSM LOCATION

Coiling is the safest option for an aneurysm located in a difficult position, such as the brain stem.

FACTOR FOUR: ARTERIAL SYSTEM ANATOMY

Unlike clipping, coiling requires that neurosurgeons navigate the arterial system from the femoral artery to the brain aneurysm. It is difficult to navigate the catheter through an arterial system that is tortuous. Thus, patients with a convoluted arterial system would benefit more from clipping.

What are the risks?

All surgical procedures carry a certain amount of risk, and coiling and clipping are no different. Risks from these surgeries include:

- Bleeding from aneurysm rupture
- Stroke
- Loss or alteration of brain function
- Death
- Surgical clipping holds the additional risk of infection

What can patients expect?

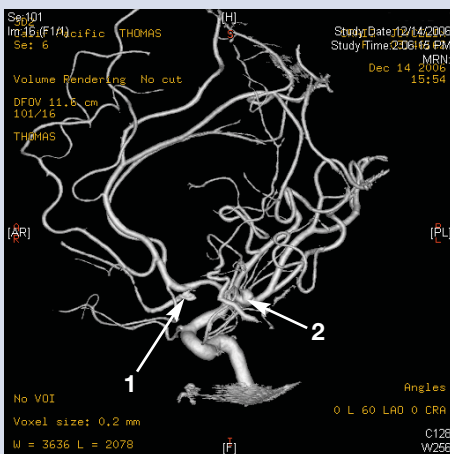
Patients receiving minimally invasive coiling or surgical clipping for cerebral aneurysm generally experience some or all of the following while in the hospital:

- 24 to 36 hours in the intensive care unit (ICU)
- Urinary catheter placement
- Catheter leg sheath in place for 24-48 hours
- Slight bruising or discomfort at the site of the sheath entrance
- Two-day hospital stay for a coiled, intact aneurysm
- Four/five-day hospital stay for a clipped intact aneurysm
- One/two-week hospital stay for ruptured aneurysm regardless of procedure
- Patients with ruptured aneurysms are at constant risk for vasospasm even after treatment, for a period of approximately 14 days following rupture.

Case Study #1

OVERVIEW:

A 43-year-old woman presented at the emergency department complaining of left sciatic pain, left leg spasms, severe headaches, and vomiting. Head CT revealed a subarachnoid hemorrhage consistent with a ruptured aneurysm. The patient was immediately admitted to the ICU and scheduled for an angiogram. While in the ICU, the patient had an episode of motor function loss at the left upper extremity.



1. Anterior communicating artery aneurysm
2. Middle cerebral artery aneurysm

PROCEDURE:

The angiogram revealed a ruptured anterior communicating artery cerebral aneurysm, as well as an intact left middle artery cerebral aneurysm. The ruptured aneurysm was coiled successfully. The non-ruptured aneurysm remained intact requiring intervention at a later date.

OUTCOME:

The ruptured aneurysm was eliminated through coil embolization with excellent neurological recovery and no permanent damage. The patient's left sciatic pain may be due to a long-standing herniated nucleus pulposus in the lumbar region, to be addressed electively at a later date. The remaining intact cerebral aneurysm will be surgically clipped, also at a later date after patient recovery. The patient



Clip on aneurysm. Skin clips on incision.

was discharged from the hospital two weeks later.

FOLLOW-UP:

The patient returned to the emergency department less than one week after discharge, complaining of severe headaches. A head CT did not reveal a subarachnoid hemorrhage, thus the left middle artery cerebral aneurysm had not ruptured. The patient was discharged the same day. The left middle cerebral artery aneurysm (unruptured) was selectively clipped four months after initial surgery. To correct the patient's herniated nucleus pulposus, the L5-S1 discs were successfully operated on by the same neurosurgeon. At followup, the patient was no longer experiencing sciatic pain.

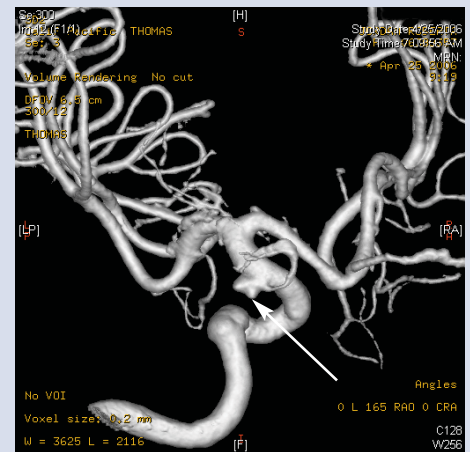
Case Study #2

OVERVIEW:

A 55-year-old woman was transferred to California Pacific with a ruptured complex cerebral aneurysm of the left internal carotid artery and subarachnoid hemorrhage.

PROCEDURE:

The patient received an angiogram with the intention of aneurysm coiling. The aneurysm was not suitable to be coiled due to its anatomical characteristics; it was multilobulated with a wide base. Therefore, surgical clipping was performed.



Multilobulated aneurysm with blebs that suggest possible rupture sites. Note small size of aneurysm that bled nevertheless.

OUTCOME:

The ruptured complex cerebral aneurysm was completely eliminated through surgical clipping. The patient was discharged from the hospital a few days later in excellent neurological condition.

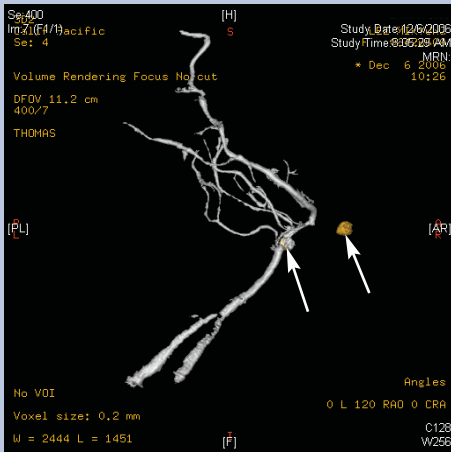
FOLLOW-UP:

The patient returned to the emergency department one month later complaining of swelling in the area of the incision anterior to the tragus. She was admitted to the hospital overnight with a diagnosis of superficial wound infection. She was discharged from the hospital six days later after the swelling subsided in response to antibiotics. She returned home in excellent condition.

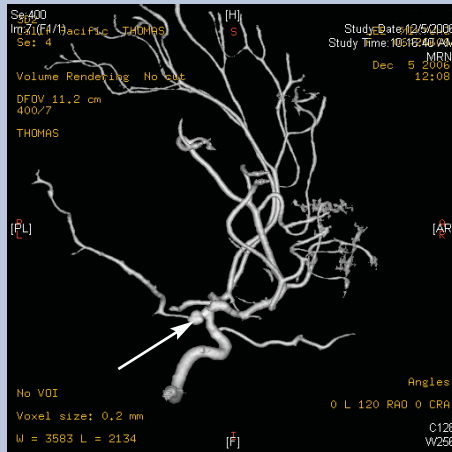
Case Study #3

OVERVIEW:

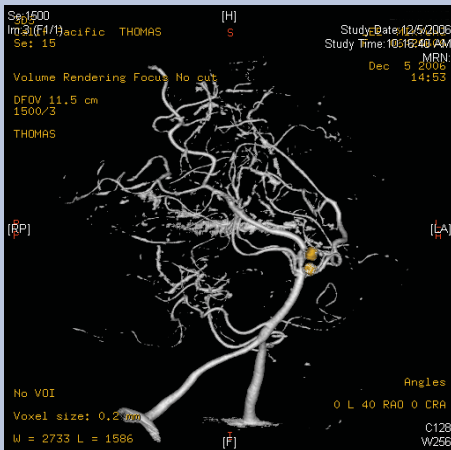
A 43-year-old woman was transferred to California Pacific with an aneurysmal subarachnoid hemorrhage. The patient suffered from two cerebral aneurysms, one intact and one ruptured, and complained of severe headaches with altered mental status, nausea, vomiting, and long-standing depression.



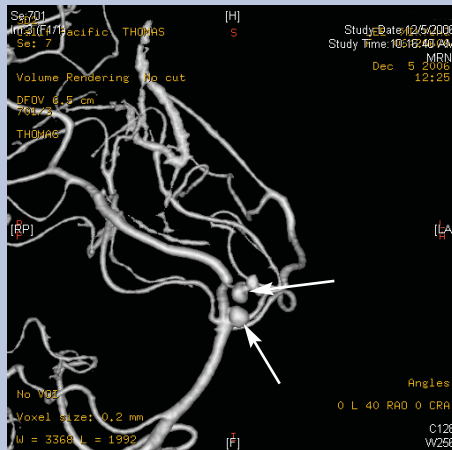
Double coil of separate aneurysms of both anterior and posterior circulations in the same patient.



Aneurysms



Posterior communicating artery aneurysm.



Multiple cerebral aneurysms (20% incidence).

Patient referral

For EMERGENCY TREATMENT CALL 911 or go to the NEAREST EMERGENCY DEPARTMENT.

For non-emergency patients, please call our referral coordinators at 1-888-637-2762. Patients need a referral from their primary care provider prior to scheduling appointment. Medical records, pertinent laboratory reports, and imaging reports should be forwarded to the neurosurgeon to determine referral indication appropriateness. All patients are seen in consultation prior to scheduling treatment.

PROCEDURE:

Both the ruptured and intact cerebral aneurysms were coiled with no complications. A follow-up angiogram indicated that the aneurysms had been successfully eliminated.

OUTCOME:

The patient was discharged from the hospital six days after coiling in excellent neurological condition.

FOLLOW-UP:

Upon her six-month follow-up visit the patient remains neurologically stable and in excellent health.

For More Information

For patient referrals or more information about California Pacific Medical Center's Neuroscience Institute or neurosurgery for cerebral aneurysm, please call 1-888-637-2762.

www.cpmc.org/neuroscience

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