A RESOURCE FOR PATIENTS

Up to 6 percent of the population of the United States may be living with an unruptured aneurysm, while an estimated 30,000 people will experience a ruptured cerebral aneurysm in the next year. Of these, 40 to 50 percent of those with a ruptured aneurysm will survive, with only 20 percent of these patients having no permanent damage.

The key to overcoming an aneurysm is early detection and interventional treatments. Cleveland Clinic’s Neurological Institute is internationally known for superior diagnosis and treatment of neurological disorders ranging from the common to the most complex, as well as for its major contributions to the understanding of aneurysms and cerebrovascular disease.

USING THIS GUIDE

Please refer to this guide as you examine your treatment options. Remember, it is your right as a patient to ask questions and seek a second opinion.

The Neurological Institute’s Cerebrovascular Center integrates a multidisciplinary team of neurologists, neurosurgeons, neuroradiologists, neurointensivists and rehabilitation specialists who provide expert diagnosis and medical, endovascular and surgical management of all cerebrovascular conditions.

More than 300 specialists in the Neurological Institute combine clinical expertise, academic achievement and innovative research to accelerate transfer of investigational therapies for the benefit of adult and pediatric patients.

Among recent advances, a Cleveland Clinic neurosurgeon has pioneered an endovascular surgical technique to treat aneurysms that occur where blood vessels branch off. Two flexible stents (devices used to support tissue as it heals) are joined in a Y-configuration, which allows blood to continue to flow through both arms of the blood vessel. Previously, this type of aneurysm was treatable only by open surgery.
WHAT IS A BRAIN ANEURYSM?

A brain aneurysm is an abnormal bulge in a brain artery that develops where the blood vessel wall is weakened. Think of the artery as a garden hose. If the rubber in a section of the hose becomes thinner, the hose will develop a balloon-like bulge at that point. While the hose may still work, water pressure could cause leaks in the stretched out hose wall or even cause the hose to burst. Similarly, a brain aneurysm may allow blood to leak into the subarachnoid space around the brain, causing damage to brain cells. The aneurysm may also rupture, causing a serious and perhaps fatal stroke. A ruptured aneurysm requires emergency medical treatment, as the likelihood of death or disability is high. Ten percent to 20 percent of those who have a subarachnoid hemorrhage will die before getting to a hospital.

It is impossible to predict if and when a rupture of a brain aneurysm may occur.

RISK FACTORS

While aneurysms occur in all age groups, their incidences steadily increase for individuals over age 25, and are most frequently found among those 40 to 60 years old. In addition, women are more likely to have aneurysms than men.

It’s not clear why aneurysms form, but researchers believe a number of risk factors contribute to their development. Some of these risk factors are present at birth, while others develop over time. They include:

- Smoking
- Severe traumatic head injury
- Family history
- Ehlers-Danlos syndrome, Polycystic kidney disease or Marfan’s syndrome
- Blood infections
- Atherosclerosis (plaque buildup in the arteries)
- High blood pressure (hypertension)
- Drug or alcohol abuse

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“I was completely blindsided by the diagnosis. The aneurysm was like a time bomb that could burst at any time. I am grateful for my life, and amazed that after such a serious injury, I basically walked away and returned to work. I have a full life ahead of me, and it’s amazing that I can live to tell about it. You would never know that I had brain surgery.”

— Danielle DeBerry, 26, Shaker Heights, Ohio
**CAN ANEURYSMS BE PREVENTED?**

Common-sense lifestyle changes may be beneficial in preventing aneurysms and other health conditions. They include:

- Not smoking
- Exercising regularly
- Eating a balanced, low-fat diet
- Getting help for alcohol and/or drug abuse
- Controlling high blood pressure

**Familial Aneurysm Clinic**

Cleveland Clinic Cerebrovascular Center is pleased to introduce the Familial Aneurysm Clinic. This Clinic is designed to offer screening for patients who are at higher risk of having an aneurysm because of family history of vulnerability to this condition.

Candidates at risk include those with a family history of diagnosed aneurysm in two or more blood relatives, especially if the following conditions are present:

- Hypertension
- Atherosclerosis
- Smoking
- Drug use (especially cocaine)
- Head injury (or history of)

At-risk candidates will receive a complete history & physical, neurological assessment and lifestyle risk assessment. Appropriate imaging and laboratory tests may be ordered, such as a CT or an MRI. In some cases, a referral is made to the Genetics Center.

Once examination and test results are complete, patients will work with their Familial Aneurysm Clinic medical team to determine the best surveillance and management options. It is recommended that patients with no symptoms or evidence of aneurysm follow up approximately every 3 years for continued monitoring.

For an appointment with our Familial Aneurysm Clinic, call the Cerebrovascular Center Rapid Consult Line at 216.445.1587 or toll free at 800.CCF.CARE, ext. 51587.

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**What are the signs of a ruptured aneurysm?**

A ruptured brain aneurysm is a life-threatening event requiring emergency medical treatment. A significant symptom is a sudden, severe headache that is often as described as the “worst headache” ever. Other symptoms may include:

- Stiff neck
- Drowsiness
- Nausea
- Vomiting
- Mental confusion
- Dizziness
- Vision problems
- Traumatic brain injury

Unfortunately, many aneurysms are discovered only after they rupture, because people with unruptured brain aneurysms often have none of these symptoms.
What Are the Treatment Options for Aneurysm?

There are a number of factors to be considered in determining the best treatment options for brain aneurysm. First, imaging tests – such as magnetic resonance imaging (MRI), computed tomography (CT), cerebral angiogram magnetic resonance angiography (MRA) or computed tomography angiography (CTA) – may be used to detect the size, shape and location of the aneurysm. Other factors include a patient’s age, overall health and hemorrhage risk. For some patients, the risks of treatment outweigh the potential benefits, and treatment is not recommended.

Current treatment options include:

Open microsurgery, also referred to as a craniotomy, is performed through a surgical opening in the skull. Using an operating microscope and tiny instruments, the surgeon attaches a small metal clip at the base of the aneurysm. (Think of it as the end of a balloon being secured by a twist-tie.) Because blood is prevented from flowing into the aneurysm, the chances of it rupturing are greatly reduced. Recovery time typically is four to six weeks.

Endovascular surgery is performed through a catheter (a flexible tube) threaded through the blood vessels from a blood vessel in your leg. Thin platinum wires are pushed into the aneurysm, where they coil into a mesh ball. (Think of it as a balloon being filled with a tangle of yarn.) Because blood clots form around the coils, the chances of it rupturing are greatly reduced. Recovery time typically is two to four days.

The Pipeline® Embolization Device allows for true reconstruction of large or giant wide-necked intracranial aneurysms. The Cerebrovascular Center is one of the few centers in the United States skilled in using this device, a fine-mesh stent that diverts blood flow away from the aneurysm causing the blood that remains in the aneurysm to form a blood clot. This clot prevents rupture of the aneurysm and may cause it to shrink over time. Previously, surgical repair of these large and giant aneurysms was difficult, dangerous and sometimes impossible, even for experienced neurosurgeons. The Pipeline Embolization Device provides a potential cure for patients who would otherwise have a very poor long-term prognoses.

Rehabilitation Services

In collaboration with the Neurological Institute's Department of Physical Medicine and Rehabilitation, we offer a full spectrum of rehabilitation services designed to return aneurysm patients to the best possible quality of life.

Our continuum of care spans all phases of the rehabilitative process, from hospital to home. Our multidisciplinary team of rehabilitation specialists includes physiatrists, neurologists, rehabilitation nurses, physical and occupational therapists, speech and language pathologists, psychologists, social workers, recreational therapists and case managers.

These professionals help patients with cognition, mobility, communication, self-care and more. Rehabilitation begins at the inpatient stage and continues on an outpatient basis, including support from Cleveland Clinic Home Care Services, if needed. Comprehensive rehabilitation services for pediatric patients are offered through our Children's Hospital for Rehabilitation.
RESEARCH

The Neurological Institute conducts a robust research program that fosters a culture of innovation and collaboration. Physicians and scientists within the Institute work closely with colleagues in the Lerner Research Institute, the basic science research arm of Cleveland Clinic, pursuing laboratory-based and clinical research as well as translational research that applies laboratory findings to improve patient care. Cleveland Clinic patients benefit from the latest treatment modalities at the Neurological Institute, where scientists and clinicians work together to advance innovations and accelerate the process of bringing novel therapeutic agents from the laboratory to the bedside.

ACCESS TO CLINICAL TRIALS

More than 100 clinical research trials with more than $7 million in supported funding are currently under way at the Neurological Institute. Here, a multidisciplinary research group combines the expertise and clinical knowledge of the investigators with the techniques of information, data analysis technology, and data gathering to generate new knowledge in the treatment of neurological diseases. The group includes staff physicians, clinical fellows, full-time research fellows, residents, nurses, and certified research coordinators.

The Cerebrovascular Center participates in numerous clinical studies and trials to investigate newer approaches to treatment. For example, patients may qualify to participate in studies investigating possible genetic links to the development of brain aneurysms. To learn more about our clinical trials, call Amy Richmond, at 216.444.9524.
ABOUT THE CEREBROVASCULAR CENTER

Cleveland Clinic is a nonprofit multispecialty academic medical center, consistently ranked among the top hospitals in America by *U.S. News & World Report*. Founded in 1921, it is dedicated to providing quality specialized care and includes an outpatient clinic, a hospital with more than 1,300 staffed beds, an education institute and a research institute.

One of 26 institutes at Cleveland Clinic, the multidisciplinary Neurological Institute is committed to improving outcomes while treating patients with compassion and respect. By bringing together physicians from different training backgrounds and experiences, the Institute’s Cerebrovascular Center offers a collaborative, multidisciplinary environment to meet the needs of patients suffering from cerebrovascular disorders. This unique disease-centered approach allows individualized care for each patient, bringing together a variety of expert perspectives, including:

- Board-certified vascular and interventional neurologists
- Board-certified cerebrovascular and endovascular neurosurgeons
- Board-certified Interventional neuroradiologists
- Board-certified neurointensivists
- Stroke prevention and rehabilitation specialists
- Pediatric stroke neurologists

Cerebrovascular Center patients are seen at our main campus in Cleveland and at locations throughout Northeast Ohio.

In addition to brain aneurysms, the Cerebrovascular Center provides treatment for stroke, brain and spinal vascular malformations, carotid stenosis, intracranial atherosclerosis and other cerebrovascular conditions. If you or someone you know has a cerebrovascular disorder, please do not hesitate to contact us.
QUESTIONS TO ASK WHEN CONSIDERING A PROVIDER FOR ANEURYSM CARE

Q: Is the Neurologist/Neurosurgeon Fellowship trained?
A. Our stroke neurologists and cerebrovascular and endovascular neurosurgeons are fellowship trained. Their areas of expertise combine research, education and clinical practice to provide innovative and scientifically based treatments for cerebrovascular disease with the highest quality patient care.

Q: Do you work within a multidisciplinary team?
A. The Cerebrovascular Center at Cleveland Clinic understands the importance of tailoring therapy for each patient. By bringing together physicians from different training backgrounds and experiences, we offer a collaborative, multidisciplinary environment to meet the needs of patients suffering from cerebrovascular disorders. This unique disease-centered approach allows us to approach each patient with a consensus plan, benefiting from a variety of expert perspectives including:

- Board-certified vascular neurologists
- Board-certified cerebrovascular and endovascular neurosurgeons
- Interventional neuroradiologists with training in neurosurgery, radiology and neurology
- Neurointensivists
- Neuro-anesthesiologists
- Stroke prevention and rehabilitation specialists

Q: How many cerebrovascular cases does the surgeon treat each year?
A. Our Cerebrovascular Center team completed more than 1,000 surgical/interventional procedures last year with 1,499 admissions and 4,219 outpatient visits.

Q: Will I be cared for in a dedicated NICU (Neurological Intensive Care Unit) with Neurointensivists present in the unit 24/7?
A. Within our 22-bed, state-of-the-art dedicated Neurointensive Care Unit (NICU), we treat more than 1,300 patients per year, with 24/7 coverage. This full service NICU is equipped to treat any patient with neurological injury, regardless of the severity. The NICU also is equipped to handle any heart, lung and gastrointestinal problems that may arise in neurological patients. In addition, we have specialized equipment specifically for the treatment of patients with neurological illnesses, including inside-the-brain oxygen sensors and blood flow monitors, and portable head Computed Tomography (CT) scanning.

Q: What is the average length of stay?
A. The length of your stay in the hospital is one indication of how good the entire care team, from physicians to nurses and others, are in expediting your recovery and return to home. At the Cleveland Clinic Cerebrovascular Center, we have achieved and maintained average lengths of stay for our patients consistently below national benchmarks for four years in a row. The expected length of stay in the hospital will vary based on your particular condition and treatment, but at the Cerebrovascular Center many treatments can now be done without a single night spent in the hospital.

Q: What are your mortality rates?
A. Cleveland Clinic Cerebrovascular Center mortality rates have remained well below the national averages for several years. This results from our patients having access to the highest levels of specialty care and the resources available to respond to patient needs 24 hours per day. Make sure the physician you select has extensive experience treating your condition and has a multidisciplinary team. Experience counts and good outcomes similar to the Cerebrovascular Center depend on a team approach.
Our staff

**Peter Rasmussen, MD, FAHA, FAANS**  
*Director, Cerebrovascular Center*

**Specialty Interests:** cerebrovascular and endovascular neurosurgery

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**Mark Bain, MD**

**Specialty Interests:** Microsurgical and endovascular treatment of cerebral aneurysms, vascular malformations, skull base cerebrovascular surgery, treatment of giant intracranial aneurysms, intracranial bypass, treatment of spinal cord vascular lesions, endovascular treatment of stroke and intracranial occlusive disease, stenting and surgical treatment of carotid disease

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**Dhimant Dani, MD**

**Specialty Interests:** ICU management of stroke, subarachnoid hemorrhage, traumatic brain injury, neurological emergency requiring ICU care

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**Erin Dyer, MD**

**Specialty Interests:** comprehensive neurosurgical and endovascular management and treatment of brain and spinal vascular lesions, carotid artery disease and emergency interventional stroke treatment

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**Neil Friedman, MBChB**

**Specialty Interests:** pediatric neuromuscular disease, pediatric stroke and cerebrovascular disease, neurocardiology, fetal and neonatal neurology

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**Jennifer A. Frontera, MD**

**Specialty Interests:** Neurointensive care; cerebrovascular diseases, subarachnoid, intracerebral or subdural hemorrhage, acute or malignant stroke, vascular malformations, aneurysms, status epilepticus, delirium, encephalopathy, coagulopathy, traumatic brain injury, spinal cord injury, autoregulation, hepatic encephalopathy

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**Joao Gomes, MD**

**Specialty Interests:** acute stroke treatment, stroke imaging, therapeutic hypothermia for neuroprotection, intracranial hemorrhages, vascular malformations and aneurysm, neurocritical care

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**Ferdinand Hui, MD**

**Specialty Interests:** interventional and therapeutic neuroradiology, MR flow imaging, cerebrovascular disease, intracranial atherosclerosis, kyphoplasty

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**M. Shazam Hussain, MD, FRCPC**

**Specialty Interests:** cerebrovascular diseases, acute stroke therapy, neuroimaging, carotid dissection, vertebral artery stenosis/ blockage, endovascular therapy (coiling, stenting)

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**Irene Katzan, MD, MS**

**Specialty Interests:** stroke, intracranial stenosis, carotid stenosis, outcomes of cerebrovascular diseases
John Lee, MD  
**Specialty Interests:** neurorehabilitation, geriatric rehabilitation, spasticity management, exercise physiology

Mei Lu, MD, PhD  
**Specialty Interests:** cerebrovascular disease, intracerebral hemorrhage, stroke, neuromuscular disease

Gwendolyn Lynch, MD  
**Specialty Interests:** neurocritical care, stroke, neurocritical care quality measures, stroke epidemiology, risk factor modification

Edward Manno, MD  
**Specialty Interests:** cerebrovascular disease, AVMs, intracranial aneurysms, hemorrhagic and ischemic stroke, neurocritical care, neurological intensive care, stroke epidemiology

Thomas Masaryk, MD  
**Specialty Interests:** interventional and therapeutic neuroradiology, MR flow imaging, cerebrovascular disease, degenerative diseases of the spine

Laurie McWilliams, MD  
**Specialty Interests:** intracranial hemorrhage, cerebral hemorrhage and hemorrhagic stroke, status epilepticus

J. Javier Provencio, MD, FCCM  
**Specialty Research Interests:** neurological intensive care, neuroinflammation in clinical illness

Andrew Russman, DO  
**Specialty Interests:** stroke, TIA, cervical artery dissection, intracranial and extracranial stenosis, concussion, post-concussion syndrome

Gabor Toth, MD  
**Specialty Interests:** aneurysm coiling, AVM, carotid-cavernous fistula, intracranial stenosis/blockage, neuroimaging, stenting, stroke and cerebrovascular disease, TIA, carotid and vertebral artery stenosis/blockage, carotid and vertebral artery dissection/pseudo aneurysm

Susan Samuel, MD  
**Specialty Interests:** ICU management of subarachnoid hemorrhage, intracerebral hemorrhage, cerebral edema, stroke

Ken Uchino, MD  
**Specialty Interests:** carotid artery disease, hemorrhagic stroke, intracranial stenosis, ischemic stroke, neurovascular ultrasound, stroke epidemiology

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**CONTACT US**

Please call 216.636.5860 or toll free at 866.588.2264 to schedule an appointment. Or call the Cerebrovascular Center Consultation Line at 216.445.1587 or Toll Free: 800.CCF.CARE, extension 51587.

For more information, visit clevelandclinic.org/brainaneurysm
CEREBROVASCULAR CENTER CONSULTATION LINE

For patients with known or suspected vascular disorders of the central nervous system (brain, head and neck, spine), Cleveland Clinic’s Cerebrovascular Center developed a consultation service directed specifically to the patient. This service is available to patients anywhere and does not require an in-person appointment for the initial consultation.

Patients may access this service through a dedicated “Cerebrovascular Consultation Service” phone line. A nurse or physician assistant will take your call and provide assistance or will get back to you within one to two business days to initiate the consultation. In many cases, you won’t even need to leave home to receive the consultation results and determine your next steps.

To contact the Cerebrovascular Consultation Line, please call: 216.445.1587 or Toll Free: 800.CCF.CARE, extension 51587.

Same day appointments available. To make an appointment with a specialist in the Cerebrovascular Center, please call 216.636.5860 or toll-free 866.588.2264. Patients are seen at our main campus, Hillcrest Hospital, Lakewood Hospital and Cleveland Clinic Florida.

Cleveland Clinic Florida
2950 Cleveland Clinic Blvd.
Weston, FL 33331
877.463.2010

Hillcrest Hospital
6780 Mayfield Road
Mayfield, OH 44124

Lakewood Hospital
14519 Detroit Avenue
Lakewood, Ohio 44107

Main Campus
9500 Euclid Avenue
Cleveland, Ohio 44195
Cleveland Clinic

Every life deserves world class care.

9500 Euclid Avenue, Cleveland, OH 44195

Cleveland Clinic’s Neurological Institute is dedicated to the diagnosis and treatment of common and complex neurological disorders of adult and pediatric patients. Its more than 300 specialists combine expertise and compassion to achieve measurably superior results. By promoting innovative research, the Neurological Institute accelerates the development and application of new treatments and technologies to patient care. The Neurological Institute is one of 26 institutes at Cleveland Clinic, a not-for-profit academic medical center ranked among the nation’s top hospitals (U.S. News & World Report), where nearly 3,000 physicians in 120 specialties collaborate to give every patient the best outcome and experience.
clevelandclinic.org

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