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Brain Tumors
Aneurysms
Craniotomies
Carotid Arteries
Head Trauma

Understanding Your Surgery and Care
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The members of your healthcare team will work with you during the course of your treatment. They help guide you through your treatment choices, address your questions and concerns, and give you support. Following are some of the people who make up your healthcare team.

A medical oncologist is a doctor specializing in diagnosing cancer and treating it with chemotherapy.

A neurologist is a doctor who diagnoses and treats diseases of the nervous system.

A neuro-oncologist is a doctor who specializes in treating tumors of the nervous system.

A neurosurgeon is a surgeon who operates on brain tumors, spine and other problems of the nervous system.

A nurse provides patient care, teaching, and support.

A nurse practitioner or clinical nurse practitioner is a nurse with special training that may help the doctor in managing a patient’s symptoms, adjusting medications, and performing medical exams.

A physician assistant (PA) is a non-physician clinician licensed to practice medicine with a physician’s supervision. They can prescribe medications. Sometimes you will see a PA in the clinic and in surgery.

Physical, occupational, and speech therapists help patients improve strength and motor skills, relearn daily tasks, and improve language and swallowing skills.

A radiation oncologist is a doctor who specializes in using radiation therapy to treat cancer.

A case manager or social worker helps guide you through the healthcare system.
Breathing, blood pressure, heartbeat and the ability to move and feel are controlled by the brain. It’s the brain that makes you able to think, to show emotions, and to make judgments. The brain is protected by the skull, tissue, and fluid.

A brain tumor can damage the parts of the brain that control these functions.

Roles & Functions of the Brain

When you have a tumor, the part of the brain surrounding it may be damaged and the brain can’t do its job properly. The brain’s right side controls the left side of the body. The left side of the brain controls the body’s right side. Some skills and traits occur in more than one section.

Inside the Skull and Protecting the Brain

Under the scalp and the skull, a tough membrane, called the dura, surrounds the brain. Beneath the dura, cerebrospinal fluid (CSF) cushions the brain. Arteries carry nutrients and oxygen-rich blood throughout the brain. Without this blood, brain tissue quickly dies.
Angiography: a special contrast “dye” and x-ray images are used to make a map of your vessels. You are injected with the dye as x-rays are taken. Before your angiography, you will get instructions on how to prepare.

Arteriogram: shows size, shape, and location of an aneurysm; can reveal any vasospasm. After local anesthesia, a catheter is guided through the arteries from the groin to the neck. Contrast dye is released, travels to the brain, and then x-rays are taken, showing the arteries and any aneurysm.

Astrocytoma: a tumor that arises from the cells that make up the supportive tissue of the brain. Classified in order of increasing malignancy.

Benign: slow-growing, not cancerous.

Catheters: tubular flexible surgical instrument used to introduce or withdraw fluids.

Cerebrospinal Fluid (CSF): fluid that surrounds the brain and spinal cord; provides buoyancy; cushions the brain from impact with bones of the skull and drains unwanted substances away from the brain.

Computerized Tomography Scan (CT): fast, painless test that creates an image of the brain; shows if any blood has leaked around or into the brain. In some cases, CT angiography may be done to produce an enhanced image that shows an aneurysm. For the test, a contrast dye is injected into a vein. This dye travels to the brain arteries, the CT scan is done to locate bleeding or other problems.

Doppler/Duplex Ultrasound: a noninvasive test performed by a technologist or doctor using special sensor (doppler) to locate and access patency of blood vessels, monitor pulses or to detect the movement of blood flow; an image then forms on a monitor; allows...
the clinician to hear blood flow to determine if there is an obstruction. Examples include carotid doppler ultrasound or transcranial doppler ultrasound.

**Glioblastoma Multiforme (GBM):** the most malignant astrocytoma. It grows quickly and contains areas of dead tumor cells.

**Intracranial Pressure (ICP):** pressure within the brain.

**IV (intravenous):** access into a vein.

**MRA (Magnetic resonance angiography):** an MRI exam of the blood vessels. Unlike traditional angiography, MRA is considered non-invasive. You lie on a long, narrow table, the table slides into a tunnel that contains a magnet.

**Malignant:** growing quickly, cancerous.

**Medulloblastoma (MDL):** common form of a PNET, arising in the cerebellum. It occurs most often in children and young adults.

**Meningioma:** a tumor that grows slowly from the meninges (covering) of the brain and spinal cord. It is often benign and rarely spreads.

**Metastatic Brain Tumor:** a tumor that has traveled to the brain from another site in the body.

**MRI (magnetic resonance imaging):** uses strong magnets and radio waves to form a sharp image. You lie on a long, narrow table, the table slides into a tunnel that contains a magnet. Expect to hear a loud banging sound during the test.

**Necrosis:** death of surrounding tissue.
Definitions

**Nervous system:** the brain and spinal cord, and the nerves branching from them

**Pathology:** the study of changes in the cells and organs of the body that cause or are a result of disease

**Pituitary Adenoma:** a slow-growing benign tumor of the pituitary gland

**Primary:** located where it started growing – the original tumor as opposed to one that spread from somewhere else in the body

**Primitive Neuroectodermal Tumor (PNET):** a fast-growing malignant tumor that contains undeveloped brain cells. It occurs most often in the cerebrum (the frontal, temporal, parietal, and occipital lobes)

**Shunt:** a small tube to direct or bypass either by natural passages or by surgical intervention

**Spinal Tap or Lumbar Puncture:** procedure that involves the introduction of a hollow needle between two vertebrae in the spine. The lower back is numbed with a local anesthetic; a needle is inserted in the lower spine. Fluid is removed through the needle and examined to rule out other problems, such as infection or blood leaking into the CSF

**Stereotactic:** method of locating specific sites in the brain using computer software, a headframe, and imaging tests

**Trigeminal neuralgia:** a neuropathic disorder of the trigeminal nerve that causes episodes of intense pain in the eyes, lips, nose, scalp, forehead, and jaw

**Ultrasound:** uses sound waves to make images of your vessels, arteries, and veins
If there is time before surgery, you may be told to do the following to help your surgery go more smoothly:

Tell your doctor about any medications you’re taking (including aspirin), and ask if you should stop taking them.

Don’t eat or drink anything after midnight before surgery including water, chewing gum, and breath mints.

If your doctor tells you to take medication the morning of surgery, swallow it with only small sips of water.

Weeks ahead of time, you may be asked to donate blood for your surgery.

If you smoke, you should stop now.

Shortly before the day of your procedure, you will have an exam. This ensures that you are healthy enough for surgery.
Be a good listener. Also, be sure to keep all family members involved, including children. You and your loved one will go through stages of feelings. Your ability to share these feelings and listen will help keep your loved one from feeling alone. The treatments your loved one is having may seem frightening.

To help ease any fears, learn about how the treatment works. Your loved one may feel guilty for needing to rely on you so much.

Make this easier by offering to help when you can and by arranging for others to be there when you cannot.

Take time for yourself. You will be more of a help if you take time to rest and keep up with the needs of your own life.

Support the patient by offering to help with daily tasks. Go along to appointments, run errands, and cook. Help with filling out forms and balancing the checkbook.
The healthcare team will want to prevent and control complications, but the timing of surgery may depend on you or your loved one’s condition.

After treatment, observation occurs. The team will want to see how well the surgery worked. Waiting for answers can be tiring. You may choose to let some people go home and rest, then others can wait for news.

You will be shown a nearby room where you can wait during surgery. A craniotomy, for example, often takes three to five hours, or more. If possible, be sure one person is always in the waiting room to receive news.

The doctor will talk with you when surgery is over. You’ll also be told when you can visit your loved one.

Make sure all follow-up visits are kept and check that all medications are taken as directed. Be patient with mood swings, pain, or fatigue that your loved one may feel.

Talk to the doctor if any sadness does not pass with time. When your loved one is ready, find ways to help them return to their normal daily activities.

Patients may also suffer with memory loss, decreased ability to concentrate, and multitask. Most, if not all of these, should improve with time.
What is a Brain Aneurysm?

A brain aneurysm is a balloon-like bulge in the wall of a brain artery. If this bulge tears and bleeds, nearby cells may be damaged. A brain aneurysm can occur in an artery wall that is weak or has a defect. An aneurysm is often associated with hardening of the arteries, high blood pressure, heredity, or a head injury.

Symptoms

In most cases, a brain aneurysm has no symptoms until it bleeds or tears. Symptoms include:

- Severe headache - “Worst headache of your life”
- Nausea and vomiting
- Neck stiffness
- Brief blackout
- Confusion or sluggishness
- Vision or speech problems
- Paralysis/weakness on one side
- clumsiness or jerking movements

Prompt Treatment Can Save a Life

A brain aneurysm needs to be treated as soon as possible. If the aneurysm has torn and bled, treatment may not reverse the
resulting damage, but surgery may help prevent more bleeding. Blood trapped in and around the brain may also be removed.

**A Time of Many Questions**

It’s normal to have many questions about you or your loved one’s health. Special tests will be done to confirm what is causing the symptoms. Once the cause is known, specialists are called, and treatment will begin right away.

**What To Do**

You or your loved one may be too ill to know what’s going on and may need to have someone else decide on treatment. Choose a few family members to talk to the healthcare team. These family members can share what they learn with others. This makes it simpler to keep everyone informed.

**Types of Brain Aneurysm**

Four main types of Brain Aneurysms exist. Most aneurysms occur where an artery branches, often at the base of the brain. Treatment options vary depending on the type of aneurysm, size, and location.
When an Aneurysm Bleeds

In most cases, the bleeding stops quickly, but if blood that has leaked touches brain cells, the cells may be damaged. Blood in the cerebrospinal fluid (CSF) increases pressure on the brain. Leaked blood may also touch nearby arteries and may cause these arteries to narrow.

Damage to Brain Cells

Blood from an aneurysm can leak into the CSF in the space around the brain (the subarachnoid space). The pool of blood forms a clot, called a hematoma. Blood can irritate, damage, or destroy nearby brain cells and may cause problems with body functions or mental skills. Leaked blood may be removed during surgery.

Fluid Buildup in the Brain

Blood from a torn aneurysm can block CSF circulation, leading to fluid buildup and...
increased pressure on the brain. The open spaces in the brain (ventricles) then enlarge (called hydrocephalus). It can make a patient lethargic, confused, or incontinent. Fluid may also build up in the brain after surgery. To stop fluid buildup, a drain (called an EVD or extra ventricular drain) may be placed in the ventricles to remove leaked blood and trapped CSF.

Narrowing of Nearby Arteries

An artery may narrow if leaked blood touches it. This response, called vasospasm, may happen up to three to 21 days after an aneurysm bleeds.

Vasospasm can decrease blood needed in other parts of the brain and can be fatal. The patient’s blood pressure and fluid intake are increased which increases the force of the blood and widens the artery.

Diagnosing a Brain Aneurysm

Often, the first symptom is a sudden severe headache. Most aneurysm patients describe it as the worst headache of their lives. A physical exam and a health history help to pinpoint the problem.

If a brain aneurysm is suspected, special tests can confirm it. Test results
help plan treatment, and can include a CT Scan, Spinal Tap and an Arteriogram. (See pages 4-6 for explanations).

Discussing Treatment Options

The neurosurgeon will talk with you and may refer to the Hunt-Hess scale, which helps the surgeon assess a patient’s condition. Test results and the grade of aneurysm can affect treatment options.

Treating a Brain Aneurysm

Treatment begins as soon as possible, often within 72 hours of the diagnosis. Either open surgery or an endovascular procedure may be best, but may not reverse any damage already done. The goal is to prevent further bleeding.

Open Surgery

Anesthesia is used during the surgery. The surgeon reaches the brain through the skull. After a scalp incision, small holes are made in the skull. The bone between the holes is cut and lifted away. The dura is peeled back.
Trapped and bloodied CSF may be removed. The surgeon closes off (clips) the aneurysm, or the artery leading to the aneurysm is sealed off (occluded). The dura and the piece of skull are put back in place. A device may be left in one of the small holes which measures pressure inside the skull.

**Clipping the Aneurysm**

The surgeon may put a clip on the aneurysm where it bulges from the artery. This keeps blood from entering the aneurysm. As a result, future bleeding is prevented and nearby brain tissue is protected from further damage. The surgeon makes sure that the clip is secure before finishing the surgery.

**Occlusion and Bypass**

This may be done in surgery with a bypass rather than open surgery. This can be done by the interventional neuroradiologist.

A bypass reroutes blood around the occlusion and
Brings the blood to the part of the brain that had been fed by the damaged artery. A small blood vessel is used for the bypass.

Endovascular Procedure

It may be best to stop blood flow through the artery leading to the aneurysm, which is called occlusion or embolization. An endovascular procedure may be best for some aneurysms.

This is done in an x-ray lab by a specially trained doctor, an Interventional Neuroradiologist.

Under local or general anesthesia, a catheter is guided through the arteries from the groin to the brain, and platinum coils are released into the aneurysm. The coils cause a blood clot to form in the aneurysm, which seals it off.

Risks and Complications

Both open surgery and an endovascular procedure have certain risks which include:

- Blood clots
- Swelling or bleeding in the brain
- Weakness/Paralysis
- Loss of sensation (including vision)
- Confusion
- Loss of speech or memory

- Infection
- Vasospasm
- Seizures
- Hydrocephalus
- Death
Learning about a Brain Tumor

Have you just found out that you or a loved one has a brain tumor? If so, you are likely to have many questions about the diagnosis and treatment.

Concerns About Your Life and Future

You may be wondering about the effect a brain tumor could have on your life. You may not know if you’ll be able to keep working. You may question whether having a brain tumor will affect how long you’ll live. If the patient is your child, you may wonder if he or she will still be able to go to school, play, and grow to be a normal adult. Learning about brain tumors can help you gain a greater sense of control.

What is a Brain Tumor?

It is a mass of abnormal cells in the brain and there are many types. They may be primary (starting in the brain) or metastatic (traveling to the brain from another site in the body). All brain tumors are either benign or malignant.

Your Treatment Plan

Your doctor will evaluate your condition and discuss it with you. Because there are many types of brain tumors, some of the treatments that are included here may not be right for you. Be sure to read the information that applies to your own treatment plan.
Your Role

Follow your treatment plan and keep a list of questions for your doctor. Try to stay flexible to changes in your treatment plan. Your family, friends, and healthcare provider are your support system. But you can seek further help by asking your healthcare provider about support groups. (See page 53 for more information).

What Causes Symptoms

Along with its location, the way a tumor grows can affect the symptoms you have. A tumor may affect the brain in one or more ways including:

- Destroy normal brain tissue
- Compress normal brain tissue
- Increase pressure in the brain

Symptoms you may have include:

- Headaches that may be worse in the morning
- Trouble thinking, remembering, and/or talking
- Changes in personality
- Vision problems
- Seizures or convulsions causing numbness, weakness, or loss of consciousness
- Paralysis or weakness in one part or on one side of the body
- Loss of balance or lack of coordination
- Nausea and vomiting that may be worse in the morning
Your Medical Evaluation

Your doctor will test how well your nervous system is working including checking:

- Thinking/memory skills
- Vision, hearing, talking, and swallowing
- Muscle strength, gait, coordination, and reflexes
- Ability to feel and sense of touch

Imaging Tests

Each of these tests provides images of your brain. A special contrast medium may be injected during the test to make a tumor easier to see. These tests can include a CT Scan and MRI (See pages 4 - 6 for explanations).

Planning Your Treatment

You and your doctor will discuss the best treatment. Throughout your treatment, your doctor will check your condition to see how well you are responding.

Your treatment plan is determined by the type, size, growth or changes, and location of your tumor, health history and age, and you may also have a biopsy. This is surgery to remove a sample of the tumor, which is then examined under a microscope. This allows your doctor to find out if the tumor is benign or malignant. Even a benign tumor can be a threat to your health.
Your Treatment Plan

Treatment may include surgery, radiation therapy, Gamma Knife, chemotherapy, or other medications. Treatment may be less involved for certain benign tumors, such as a pituitary tumor.

Sometimes a tumor doesn’t require treatment yet, but needs to be watched. In this case, it’s important to follow-up with your doctor.

If You Have a Biopsy

There are two types of biopsy: open and stereotactic. An open biopsy is done during a craniotomy (see page 37). With stereotactic biopsy, a sample of the tumor is taken through a small hole made in the skull bone.

Stereotactic Biopsy

This is often used if a tumor is in a part of the brain that is hard to reach. During this surgical procedure, a special frame may be used to hold the head in place. The biopsy is guided by CT or MRI scans.
Before the Procedure

Before the biopsy, part of your head may be shaved. You will have anesthesia to numb the part of your head where the surgeon will work, and most patients remain awake.

During the Procedure

The surgeon will pass a narrow, hollow needle through the skull bone into the tumor. Cells taken from the tumor will then be sent to a lab to be examined. Risks and complications include bleeding, seizures, and infection.

Reassuring Your Child

If the patient is your child, describe what you think he or she will experience before and after surgery.

Check with the preadmission department at your hospital for resources that might help. Books, teaching with puppets or dolls, and tours of the surgical wing may be offered.

If You Have a Craniotomy

A craniotomy allows an open biopsy or resection of the tumor to be done and as much of the tumor as possible to be removed. (See page 34 for full information.)
If You are Given Radiation

The goal of radiation therapy is to slow or help control tumor growth. It uses painless x-rays to destroy tumor cells and can work with other treatment.

If your doctor has selected radiation therapy for you, you may have traditional radiation or stereotactic radiosurgery.

Traditional Radiation

Focused and Whole Brain are the two main forms of traditional radiation therapy. Treatment is given in the same manner for both types, but their risks and side effects differ. Your experience for both may be as follows:

- Small marks may be made on your head to focus the x-rays
- A large machine will send x-rays from several directions
- Your treatment will be given in a series, such as five days a week for four to seven weeks

Focused Radiation

X-rays are aimed at the tumor. Short-term side effects and risks are brain swelling, fatigue, nausea, headache, seizures, hair loss, hearing loss, and skin changes in the treated area. Long-term side effects and risks are memory loss, trouble thinking, permanent hair loss, hormonal changes, and necrosis.

Whole Brain Radiation

This involves radiation to the entire brain and is most often used to treat multiple tumors. Short-term and long-term side effects and risks are the same as for focused radiation; however, because the whole brain is radiated, effects can be more severe.
Stereotactic Radiosurgery

Radiosurgery involves a single high dose of radiation. Since it is very focused, the normal tissue around the tumor receives little or no radiation. You are fitted with a headframe to keep your head in the correct position. The tumor’s location is mapped with CT and/or MRI scans.

Information from the headframe and scans is entered into a computer. This plans where to focus the radiation. A machine beams the radiation to the tumor. Two of the most common machines used are the Gamma Knife and the Linear Accelerator.

You will need to lie still during both the mapping and treatment. Medications may be given to help you relax.

Short-term side effects and risks are seizures, infection, nausea, vomiting, dizziness, headaches, and temporary hair loss. Long-term risk of necrosis exists.

If You Have Radiation Implants

Radiation implants, brachytherapy (also called interstitial radiation), may be used to control tumor growth. With this process, the radiation attacks the tumor from within the body. The implants are placed during a surgery that is followed by a hospital stay.
Brain Tumor

Brachytherapy

It’s used for small tumors and may be used with other types of radiation. You may be awake during the procedure or under general anesthesia.

Catheters are placed into small holes in the skull. The implants are sent through the catheters into the tumor and may give off a low level of radiation. You will be in a private room. Visitors may wear lead aprons or vests and you may wear a helmet.

Your hospital stay may last up to seven days. The seeds will be left in place for about five days. Some types of very low-dose seeds are left in place a few months or permanently. Side effects and risks include infection, seizures, headache, necrosis, and brain swelling.

If You Have Chemotherapy

Chemotherapy is a way of treating disease with medications. It may be given as a single medication or a combination. It may be used alone or with surgery or radiation therapy.

How Chemotherapy Works

Both normal and cancer cells grow and divide, but cancer cells spread out of control. Chemotherapy kills growing cells by interrupting their life cycle. Because it acts on normal cells as well, side effects result. Fast-growing cells – such as those in the hair, digestive system, and blood – are most affected.
How Chemotherapy is Given

It is given in cycles, which allows the body to rest and build healthy cells between treatments. You can receive your therapy in different ways:

- By IV
- By mouth, as a pill
- As a wafer implanted in the brain

Coping with Side Effects

Chemotherapy can cause side effects in different parts of your body. Some common short-term side effects and solutions are:

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea or Vomiting</td>
<td>Take antinausea medications as directed.</td>
</tr>
<tr>
<td></td>
<td>Eat small meals throughout the day.</td>
</tr>
<tr>
<td>Low Blood Cell Counts</td>
<td>A low white blood cell count makes your body less able to fight infection.</td>
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<tr>
<td></td>
<td>Wash your hands often.</td>
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<tr>
<td></td>
<td>Avoid crowds and people who are sick.</td>
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<tr>
<td></td>
<td>A low platelet count increases the risk of bleeding.</td>
</tr>
<tr>
<td></td>
<td>Avoid activities that could result in cuts or bruising.</td>
</tr>
<tr>
<td></td>
<td>A low red blood cell count, or anemia, may require treatment.</td>
</tr>
<tr>
<td></td>
<td>Call your doctor if you are very tired and pale, short of breath, or have chest pain.</td>
</tr>
<tr>
<td>Hair Loss</td>
<td>Cut your hair short to make hair loss less extreme.</td>
</tr>
<tr>
<td></td>
<td>Wear a wig, hat, or scarf.</td>
</tr>
<tr>
<td>Mouth Sores</td>
<td>Brush your teeth after each meal to keep your mouth clean and prevent infection.</td>
</tr>
<tr>
<td></td>
<td>Use a soft toothbrush.</td>
</tr>
<tr>
<td></td>
<td>Rinse with baking soda in water.</td>
</tr>
</tbody>
</table>
Long-term side effects and risks are infertility, organ damage, and numbness and tingling in the hands and feet.

Talking to Your Family and Friends

You may find it hard to talk about your brain tumor and its treatment. But you may also want to let family and friends know what you are going through.

Let them know that there is no right thing to say. Assure them that showing they care is helpful.

Expect people to respond in different ways. Some may seem angry, while others may refuse to hear any more, or seem too upbeat, saying that everything will be fine. Know they all mean well.

Don’t overwhelm children. Explain what’s happening in a manner that they can understand. Do this whether the patient is your child or someone close to your child.

When children sense that something is going on but it hasn’t been explained, they may blame themselves.
What is a Carotid Artery Problem?

The two common carotid arteries are blood vessels in the neck that supply oxygen-rich blood to your brain. Each carotid artery branches into an internal and external artery. When one of these vessels becomes narrowed, your brain can’t get enough oxygen and can lead to a stroke (sometimes called a brain attack).

Symptoms of a Stoke or “Mini-Stroke”

If blood flow to part of your brain stops, even briefly, you may have symptoms of a stroke or “mini-stroke.” Seek medical help right away, even if the symptoms last for only a moment. Symptoms include:

- Numbness or weakness in your arms or legs
- Sudden changes in vision or loss of vision in one eye
- Slurring your words
- A facial droop

Reducing Your Risk

Carotid endarterectomy is a surgery to reopen a narrowed carotid artery. If you’ve had symptoms of a stroke, you may need surgery right away. If you haven’t had symptoms, your doctor may watch your problem over several months before deciding to operate.
What Causes a Stroke?

A healthy carotid artery is open, allowing blood to flow to the brain. But if the inside of the artery becomes narrow and rough, a stroke is more likely to occur.

Certain health problems can cause narrowing and roughness and as the problem worsens, your risk of having a stroke can grow.

Open Carotid Arteries

The inside of the artery is open, has no signs of narrowing, is smooth and healthy. Blood flows from your heart to your brain without any problems. Your brain gets all the blood and oxygen it needs.

Narrowed Carotid Arteries

High blood pressure, high cholesterol, diabetes, and other health problems can cause a fatty substance called plaque to build up on the inside of the artery walls. Lifestyle choices such as smoking and a fatty diet can also cause plaque to build up.

The path through the artery is narrowed by plaque buildup. Plaque buildup makes the wall of the artery rough and can cause blood clots to form.

Narrowed arteries can prevent some parts of your brain from getting enough blood and oxygen to work normally.
The Dangers of a Narrowed Carotid Artery

Tiny blood clots and bits of plaque can break off and travel through the carotid artery. These are called emboli and can enter the smaller vessels in your brain. If the emboli are large enough, they can block blood flow and cause a stroke.

If You Have a Mini-Stroke (TIA)

Smaller emboli can briefly interrupt blood flow in parts of the brain. This causes a “mini-stroke,” also called a transient ischemic attack (TIA). It can last from a few moments to a full day. TIAs are very serious and can be a warning sign of a stroke.

If You Have a Stroke

Larger emboli can cut off blood flow to parts of the brain and cause a stroke. Without oxygen-rich blood, that part of the brain dies. Symptoms after a stroke depend on which part of the brain was affected. After a stroke, some people have trouble walking, can’t speak, and may die.

Your Medical Evaluation

Your doctor will evaluate you to learn more about your carotid artery problem. Depending on the results, you may have other tests. The goal is to pinpoint the problem and learn whether surgery is needed.
Medical History

Tell your doctor about your symptoms. This includes numbness, weakness, vision problems, or anything else you’ve noticed.

Discuss other health problems, such as high blood pressure or diabetes as these can increase your risk of stroke. Since health problems can run in families, you may be asked about the health of your relatives.

Physical Exam

Your doctor will take your blood pressure and listen in your neck for a bruit, a rumbling sound made when blood travels through a narrowed vessel.

Your eyes may be examined for tiny spots in their blood vessels. Your doctor may test your reflexes and strength and other tests may be ordered (see page 4 - 6).

Other Imaging Tests

A technologist or doctor may perform imaging tests which can include magnetic resonance angiography (MRA), arteriogram, and brain imaging tests.

MRA makes an image of your carotid artery without using x-rays. Brain imaging tests can show damage from a past stroke.

Do You Need Surgery?

You and your doctor will discuss the best course of treatment for you. Whether you need surgery depends on your symptoms and
how severely narrowed your carotid artery is. In many cases, surgery won’t be needed. Instead, your doctor may watch your problem over several months.

If a patient is high risk for surgery, there are other options. Carotid stents can be used to open up the carotid artery. The procedure is done by an interventional neuroradiologist.

When Surgery is Required

If you have mild narrowing, but have had TIAs, you may need surgery. Even if you haven’t had any symptoms, your risk may be high if one of your arteries is severely narrowed.

Your Treatment Plan

If surgery is needed, you’ll have a carotid endarterectomy to remove plaque, reopen, and smooth the artery, reducing the chance of emboli forming.

Even if you don’t need surgery, your doctor may suggest lifestyle changes. Controlling blood pressure, quitting smoking, eating healthier and exercising regularly help reduce your risk. You also may be given medication to help improve your blood flow.

Risks and Complications

Carotid endarterectomy has certain risks and complications. These are the same as those for a carotid stent. Some of these risks are:

- Bleeding
- Temporary trouble speaking or swallowing
- Heart attack
- Stroke
- Infection
- Death
- Death
Your Surgery

You will be given instructions on checking in and other details. Most surgeries take an hour or two, but spending at least one night in the hospital is likely.

Bring personal care items and a robe with you, but leave anything of value, such as jewelry, at home.

Checking In

If you haven’t already done so, you’ll be asked to read and sign a consent form when you arrive. It explains some details of your surgery. Your blood pressure and other vital signs are also taken at this time and an IV line may be started.

Anesthesia

Anesthesia prevents pain during surgery. A doctor trained in anesthesia will explain which type you will have. General anesthesia lets you “sleep” during the procedure.

You will awaken soon after surgery is done. Local anesthesia numbs the incision site so you don’t feel pain during surgery, but you remain awake. You also may be given medicine to relax you.
The Incision

A skin incision is made near one of the carotid arteries in your neck. The location and angle aren’t always the same. Next, an incision is made in the artery itself.

Rerouting Blood Flow

Your blood may be rerouted for a short time with a shunt. The shunt allows blood to flow to your brain while your doctor works on your artery. If blood flow is strong in your other carotid artery, you may not need a shunt.

Removing Plaque

The doctor carefully loosens plaque from the artery wall. The plaque is then removed. With the plaque gone, the chance of emboli forming is greatly reduced.

Closing Up

If you have a shunt, it is removed. Your doctor then closes the artery with sutures (stitches). Next, the skin incision is closed and a small tube may be placed in the incision to help with any drainage that may occur. A small bandage will cover the incision.
What is a Craniotomy?

A craniotomy makes a window in the bone covering the brain. This allows a surgeon to reduce pressure beneath the skull. A craniotomy also may be done to remove or repair abnormal structures in the brain.

Concerns About Recovery

You may want to know how a craniotomy will impact your life. Will it change the way you think, act, or move? Learning more about a craniotomy can help you gain a greater sense of control. It may also assure you to know that high-tech surgical methods make craniotomies a safer, more effective treatment than ever.

Why Is a Craniotomy Needed?

Certain problems keep the brain from working correctly. Access to the brain is needed to correct these problems. The problems discussed next are the most common reasons for performing a craniotomy.
Brain Injury - This can result from a direct blow to the head or even whiplash. It can cause tearing, bleeding, and swelling of the brain. The treatment goal is to stop any bleeding and reduce pressure. Blood and damaged tissue may be removed.

Brain Tumor - A tumor is a mass of abnormal cells. The goal is to remove as much of the tumor as possible. Depending on the tumor, other treatments may also be needed. (See page 17 for more details).

Aneurysm - A balloon-like defect in an artery wall. The treatment goal is to control damage and prevent further bleeding. (See page 10 for details).

Arteriovenous Malformation (AVM) - An abnormal tangle of blood vessels which prevents normal blood flow through part of the brain and increases the risk of bleeding into the brain tissue. The treatment goal is to stop blood flow within the AVM and channel it along the normal route.

Diagnosing Your Condition

Your doctor performs certain exams and tests to find the cause of your condition. The results also help learn the precise location and extent of your problem.

Craniotomy
Your Medical Exam

Your doctor finds out how well your nervous system is working by checking your:

- Ability to see, hear, walk, and swallow
- Thinking and memory skills
- Muscle strength, coordination, reflexes, and gait
- Ability to feel and sense of touch

Imaging Tests

These tests provide images of the brain and the arteries that carry blood to it. For sharper images, contrast mediums may be used with these tests. Risks and complications will be discussed with you. These tests can include a CT Scan, MRI and an Arteriogram. (See pages 4-6 for explanations).

Arranging for the Future

You may have concerns about your ability to make decisions about treatment in the future. Advance directives can help ease such worries. Recording your wishes on special legal forms helps ensure that you will get the care you want even if you can no longer make decisions. Your doctor or the hospital can provide the forms that apply.
The Day of Your Craniotomy

Arrive at the hospital on time. You may still have lingering concerns and may feel a bit nervous. Your health care team will try to answer all your questions and do all they can to put you at ease.

Just Before Surgery

The health care provider in charge of your anesthesia will talk with you. You will be given general anesthesia to help you “sleep” through the surgery. At some point, an IV line is placed in your arm. This line can supply medication and fluids as needed. In many cases, part of your head is shaved to decrease the risk of infection.
Reaching the Brain

The surgeon makes an incision in your scalp. Dime-sized burr holes are drilled in the skull and the bone between the holes is cut and lifted away. Then, the surgeon opens the dura exposing the brain. The next step depends on your specific problem.

In some cases, certain nerves may be stimulated while the response in the brain is monitored. This is to make sure that normal brain tissue is not disturbed.

Risks of Surgery

As with any surgery, craniotomy has certain risks. These include:

- Seizure (jerking movements)
- Infection
- Loss of memory or confusion
- Swelling or bleeding in the brain
- Blood clots
- Loss of sensation, including vision
- Weakness or paralysis
- Death

Correcting Your Problem

Brain Injury - The source of bleeding is controlled and blood is removed. Damaged tissue may also be cleaned away.

Brain Tumor - As much of the brain tumor as possible is removed.

Aneurysm - The artery is clipped or sealed at the leak. This prevents more blood from flowing into the brain.

AVM - The abnormal arteries and veins are clipped. This redirects blood flow to normal vessels and prevents the AVM from leaking blood.
Finishing the Craniotomy

When the goal of surgery is met, the dura is closed. In almost all cases, the skull bone is put back. It may be held in place with wire mesh or screw plates.

Sometimes blood or fluid remaining in the brain tissue needs to be removed so a drain may be placed through a burr hole for a few days. Most of the time, however, all the burr holes are filled or covered right after surgery.

Then the skin incision is closed with stitches or staples.

Other Types of Brain Procedures

The procedures below may be done alone, or they may be performed in addition to a craniotomy. To provide access for shunts or stereotactic surgery, burr holes are made in the skull.

Your hospital experience before and after these procedures may be about the same as for a craniotomy.
Shunts

This special type of drain is used to decrease pressure on the brain by removing excess spinal fluid. The fluid is drained from the brain to the abdomen through a tube tunneled under the skin. Once the fluid reaches the abdomen, it is absorbed by the body.

Stereotactic Surgery

Stereotactic surgery improves access to problems in parts of the brain that are delicate or hard to reach. CT or MRI scans are used to locate the problem and map a precise approach. During this procedure, a special frame may be used to hold the head in place.
What is Head Trauma?

Head trauma, also known as a traumatic brain injury (TBI), is caused by a blow or jolt to the head that disrupts brain function. Not all blows or jolts to the head result in head trauma. The severity may range from mild, which is a brief change in mental status or consciousness, to severe, an extended period of unconsciousness or amnesia after the injury.

Symptoms

Head trauma can cause a wide range of symptoms. This includes a wide range of functional changes affecting:

- Thinking (memory and reasoning)
- Sensation (touch, taste and smell)
- Language (communication, expression, and understanding)
- Emotions (depression, anxiety, aggression, and social inappropriateness)

Head trauma can also result in epilepsy and increase the risk for conditions such as Alzheimer’s disease, Parkinson’s disease, and other brain disorders that become prevalent with age.

How is it diagnosed?

The doctor will take into consideration how the injury occurred, as well as the
Head Trauma

symptoms. A careful neurological evaluation, checking the level of consciousness, reflexes, the size of the pupils and reaction to light, ears, pulse, blood pressure, and breathing rate is performed.

Imaging Tests

Imaging tests help in determining the diagnosis and prognosis of a TBI patient. Patients with mild to moderate injuries may receive skull and neck X-rays to check for bone fractures. For moderate to severe cases, a CT scan and MRI are standard. Other imaging and diagnostic techniques that may be used include cerebral angiography, electroencephalography (EEG), transcranial Doppler ultrasound, and a positron emission tomography (PET). (See pages 4-6 for more information).

Surgery

Many types of head trauma may require surgery in order to minimize damage to the brain. These types include primary and secondary head trauma.

Types of Head Trauma

Primary types of brain trauma include direct trauma and indirect trauma. Secondary types of brain trauma include edema, hematoma, hydrocephalus and hygroma.
Head Trauma

Direct Trauma

This includes any force that penetrates or fractures the skull that may cause severe brain injury such as destructive shock waves, that are sent through the brain matter. Displaced fractures of the skull can also push bone into the brain, causing tissue damage.

Indirect Trauma

Indirect trauma does not involve a direct blow to the head. It includes Shaken Baby Syndrome or severe whiplash. Severe shaking greatly stretches and damages delicate nerve cells, at times causing very significant injury or even death.

Edema

Edema occurs when the brain swells. This becomes dangerous when the swelling causes a rise in intracranial pressure (ICP) which prevents blood from entering the skull to deliver glucose and oxygen to the brain. If the ICP remains too high for too long, it can be relieved through medication, or in more severe cases, by placing a hole in the skull to drain off some of the high-pressure fluid.

Hematomas

A hematoma is a collection of blood due to tissue injury or the tearing of a blood vessel. CT scans are particularly effective in detecting brain bleeds. Bleeding into the brain after trauma can occur days after the patient is released from the ER or hospital.
A blood clot that develops between the dura and the skull is known as an epidural hematoma. A blood clot that forms between the dura and the brain is known as a subdural hematoma.

Gently resting against the brain itself is a thin, delicate membrane called the arachnoid. Blood leaking into the CSF is known as a sub-arachnoid hemorrhage.

**Hydrocephalus and Hygroma**

These are collections of fluid around the brain. If blood gets into the CSF and blocks the spinal fluid absorption sites, spinal fluid will back up into the ventricles, enlarging them, known as hydrocephalus.

If the pressure inside the ventricles becomes excessive, a tube may be inserted into the ventricles to relieve the pressure. A hygroma is a localized fluid buildup usually in the subdural space. If the pressure in the hygroma presses against the brain, surgery may be necessary.

**Common Causes**

Common causes of head trauma include traffic accidents, falls, physical assault, and accidents at home, work, outdoors, or while playing sports.
**Concussions**

A concussion is an alteration of conscious awareness after head trauma. The collection of symptoms following a concussion is called the postconcussion syndrome and include:

- Dizziness
- Nausea
- Vomiting
- Headache
- Disorientation
- Forgetfulness
- Irritability
- Depression
- Mood swings
- Insomnia
- Loss of libido

Most cases of postconcussion syndrome resolve after a few months, but some cases can involve longer term problems.

**Whiplash**

Whiplash is the common name for neck sprains due to the neck being thrown forwards and/or backwards at rapid speed. This may cause the fibers of the neck muscles to tear, resulting in pain and a decreased range of movement.

The brain is vulnerable in two ways. The cerebral cortex can become bruised when the head strikes a hard object. Or, the deep white matter can suffer diffuse axonal injury when the head is whiplashed without hitting a hard object. Whiplash may also cause damage to the soft tissue of the spine, such as the tearing of a disc.

**Cerebral Contusion**

Also called a bruise of the brain tissue, a cerebral contusion may be caused by multiple small blood vessels leaking blood into nearby tissue. They commonly heal without medical help.
Seizures & Head Injury

A seizure occurs when nerve cells in the brain rapidly fire electrical discharges at one another. In “grand mal” seizures, this occurs throughout the brain, and results in the patient losing consciousness, falling down, then convulsing.

Seizures may develop immediately after a brain injury or may develop in a delayed fashion, showing up months or even years after the initial trauma. The risk of post traumatic seizures is related to the severity of the injury.

Prevention

There are many ways to prevent accidents resulting in brain trauma:

Wearing a seat belt every time you drive or ride in a motor vehicle and buckling your child in the car using a child safety seat, booster seat, or seat belt (according to the child’s height, weight and age).

Wearing a helmet and making sure your children wear helmets when riding a bike, motorcycle, snowmobile, scooter or all-terrain vehicle. Also when playing a contact sport, such as football, ice hockey, or boxing or using in-line skates or riding a skateboard. Also batting and running bases in baseball or softball; riding a horse; or skiing or snowboarding.
Coping After Surgery

Accepting what has happened can be hard for you and your loved ones. Recovery will take time.

You may feel more tired than normal for a few months or even a year. Coming to terms with your emotions can help ease the process.

It’s harder to cope some days than others, so be patient. If you feel sad or depressed, talk with a member of your healthcare team. Depression is common and can be treated.

It’s normal to have fears or feel angry. Sharing with your family can also help.

When To Call the Doctor

Call your surgeon at once if you have any of the following:

- Increased drowsiness
- Ongoing nausea or vomiting
- Extreme headaches
- Seizure
- Increased muscle weakness
- Shortness of breath
- Pain swelling in a leg
- Fever of 101°F or greater
- Redness or drainage from the incision or an IV site
- Burning during urination
- Nasal drainage

Rehabilitation

Therapy may be prescribed and therapists can work with you to improve balance, strength, speech, and daily living skills.
If you are having problems with strength or movement, your therapist may suggest installing hand rails in hallways or bathrooms at home.

If you Need Other Treatment

After a craniotomy, medications are often prescribed to treat side effects and help you feel better. If you had surgery for a brain tumor, you may also have chemotherapy or radiation. (See pages 22 - 26).

After Your Hospital Stay

You may be able to go home as soon as you can walk, eat and drink normally. Back home, family and friends may offer help and support. Accept help when you need it, but it’s important to strike a balance. Keep in mind that you’re striving to become independent again.

Keep Follow-up Visits

You may have an office visit seven to ten days afterwards. At this time, any remaining stitches or staples may be removed. You can expect to meet with your surgeon about every four weeks for the first few months. You may also have follow-up imaging tests to ensure your condition is stable.
Start by Walking

Walking is a great way to rebuild your strength. Start out with short, frequent walks. Even if it’s just to get a glass of water, get up and walk each day. Gradually try walking greater distances, such as to the corner mailbox.

Taking Life Day-By-Day

Adjusting to your diagnosis and treatment can be hard for both you and your loved ones. It will take time, but there are things you can do to make the process easier.

Dealing with Emotions

Expect new feelings to emerge. You may need to absorb what you know before you can discuss it with others.

Consider counseling because it can help you deal with your fears and the demands of treatment.
Adjusting to Daily life

Say “yes” when people offer to help, such as with cooking and housework. Arrange for childcare when you need a break. Have friends and family give rides and attend school games.

If you’ve been told not to drive at this time, get help setting up rides. Talk with your social worker, case manager, or discharge planner.

Ask your employer about cutting back your work hours if your schedule is too tiring, or try working at home where you can pace yourself.

Managing Your Care

What would happen if you were no longer able to make your own decision? How are you going to pay for treatment? There are a few ways to cease your concerns.

Recording Your Decisions

Special legal forms help ensure that you’d get the care you’d want if you could no longer speak for yourself.
Depending on which state you live in, you may need to fill out one or both of the following forms:

<table>
<thead>
<tr>
<th>Durable Power of Attorney for Healthcare</th>
<th>This names someone to make healthcare decisions for you. This person is called an agent and can decide on treatments for you only if you can’t speak for yourself, and even if you are expected to recover.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Will</td>
<td>Explains in writing which treatments you want or don’t want at the end of your life. It applies only if you won’t live without medical treatment and takes effect only when you can no longer speak for yourself.</td>
</tr>
</tbody>
</table>

If you have questions or need forms, call your local hospital. Ask for the social services department and you can also call an attorney.

Other Issues

To decide what care you may need at home, you will meet with a social worker, case manager, or discharge planner before you leave the hospital.

You may require home visits from a physical therapist. You may want to set up counseling. And you may need someone to help with your day-to-day household tasks.
If you Need Medications

Brain conditions often cause symptoms and your treatment is likely to produce some side effects. To help you feel better, your doctor may prescribe medications. Ask your doctor or pharmacist about possible interaction with other medications. Always take them as directed.

Steroids

Steroids reduce brain swelling. Do not stop taking them without your doctor’s approval. Side effects can include water retention, weight gain, hair growth, insomnia, stomach ulcers, increased risk of infection, and mood changes.

Anticonvulsants

Anticonvulsants help prevent seizures or convulsions. You will have blood tests to make sure you get the right dosage. Call the doctor right away if you have any of these side effects: trouble breathing, rash, balance problems, or dizziness.

Other Medications

You may need other medications to manage symptoms and side effects. Talk with your doctor if you have problems with nausea, stomach acid, or pain. Medications may include:

- Antiemetics to control nausea
- Antacids to control stomach acid
- Laxatives or stool softeners to treat constipation
- Medications to control pain
- Hormones to replace the ones that your body isn’t producing or to treat certain types of tumors
Your social worker, case manager, or discharge planner will also help you with money matters. You may be referred to a local or national group that provides services and financial aid.

Resources

Learning More about Brain Tumors

The better you understand your condition and its treatment, the more in control you may feel. If you want, ask your doctor or nurse to suggest local and national resources.

National Associations

American Brain Tumor Association
2720 River Road, Des Plaines, IL 60018
847-827-9910  Fax: 847-827-9918  Patient Line: 800-886-2282
info@abta.org  abta.org

Brain Tumor Society
124 Watertown Street, Suite 3H, Watertown, MA 02472
1.800.770.TBTS (8287)  Fax 617.924.9998
tbts.org
Resources

National Brain Tumor Foundation
22 Battery Street, Suite 612, San Francisco, CA 94111-5520
Brain Tumor Information Line: 1.800.934.CURE (2873)
nbtf@braintumor.org       braintumor.org

Brain Tumor Foundation for Children
6065 Roswell Rd., NE, Suite 505, Atlanta, GA 30328
(404) 252-4107 Fax: (404) 252-4108
braintumorkids.org

American Cancer Society
Cancer Information Service (National Cancer Institute)
800-4—CANCER (1–800–422–6237)
cis.nci.nih.gov

Local Organizations

American Cancer Society
920 Pierremont, Suite 300, Shreveport, LA 71106
318-219-1668 Fax: 318-865-4831 800-ACS-2345
cancer.org

Please visit our website for a complete list of local support groups.
www.universityneurosurgery.com