Understanding **stroke**

What is stroke?

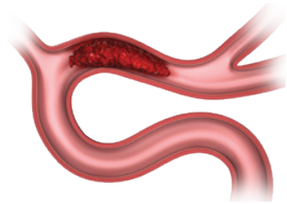
Blood vessels called arteries carry blood filled with oxygen and nutrients from the heart to the brain. A stroke occurs when blood flow through these arteries is either blocked (ischemic stroke) or bursts (hemorrhagic stroke). When this happens, the brain doesn't get the blood it needs to function properly. Depending on the severity of the stroke and the area of the brain affected, loss of brain function or brain death may occur. Motor function, speech and memory are examples of bodily functions that may be impacted.

When a stroke occurs, time is of the essence in receiving emergency medical intervention – acting quickly can make a big difference for the patient.

Ischemic stroke

Ischemic stroke is the most common type of stroke, accounting for approximately 87% of all stroke cases.[1] This type of stroke is also referred to as a "brain attack" and often happens without warning.

In ischemic stroke, the blockage of blood flow is usually caused by a blood clot or other substance such as plaque, a fatty material. If the blockage forms in an artery that supplies blood to the brain, it is called a thrombus; if the blockage forms elsewhere in the body and travels through the bloodstream to an artery in the brain, it is called an embolus.



Ischemic stroke:
clot interrupting blood flow

The primary goal in treating acute ischemic stroke is to restore the flow of blood to the parts of the brain affected by the stroke by dissolving the clot, removing the clot or by otherwise resolving the blockage. Based on the patient's symptoms, the blockage location and other diagnostic testing, the treating physician will determine the most appropriate method of care.

Hemorrhagic stroke

Hemorrhagic stroke accounts for 13% of strokes and occurs when a weakened blood vessel bursts, causing blood to leak out of the vessel and into the surrounding brain tissue. This is an emergency situation requiring immediate medical care.

There are two types of weakened blood vessels that usually cause a hemorrhagic stroke: aneurysms and AVMs.

Hemorrhagic stroke:
blood leaking out of the blood vessel into surrounding brain tissue

Aneurysm

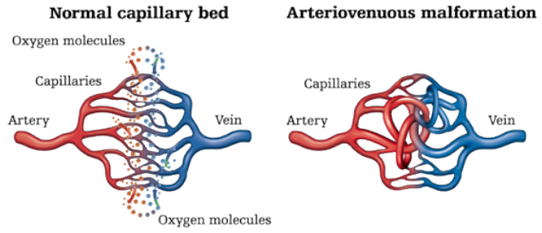
An aneurysm occurs when a part of a blood vessel becomes weak and then fills with blood, causing the vessel to balloon or bulge. This often resembles a berry on a stick. Aneurysms can occur in any blood vessel in the body. However, brain aneurysms are the most life-threatening. If left untreated, the aneurysm may continue to weaken until it bursts and bleeds into the brain.

Aneurysms can vary in size. A physician diagnoses aneurysms using specialized X-ray technology that allows him to visualize the vessels in the brain.

AVM

AVM stands for **arteriovenous malformation**, which is a condition where the connection between arteries and veins is abnormal – often resembling a tangled web.

Brain AVMs affect approximately 1% of the general population. It is a congenital disease, meaning you are born with it. A brain AVM contains abnormal "weakened" blood vessels that direct blood away from normal brain tissue. These weak blood vessels can widen over time and can affect the function of the surrounding brain tissue. In extreme cases, the blood vessel may burst from the high pressure of blood flow, causing a hemorrhagic stroke (bleeding in the brain).



How common is stroke?[1]

- An estimated 795,000 people suffer a new or recurrent stroke each year
- Every 40 seconds, someone suffers a stroke
- Every 4 minutes, someone dies of a stroke
- Stroke is the 5th leading cause of death
- Stroke is the number one cause of long-term disability
- Approximately 55,000 more women than men suffer a stroke annually
- An estimated 1 in 50 people in the U.S. have an unruptured aneurysm[2]

What's the difference between an artery and a vein?

Artery: brings blood with oxygen and nutrients to blood vessels from the heart

Vein: takes blood without oxygen or nutrients back to the heart to be replenished

What are the **effects of stroke?**

The brain controls many voluntary and involuntary functions that allow us to perform the everyday tasks we often take for granted. Voluntary functions are those that are performed with purpose, such as walking down the street and speaking to friends and family. Certain areas of the brain are in charge of these types of functions. Involuntary functions are controlled by different areas of the brain and include the ability to swallow, breathe, regulate body temperature and sleep. If blood flow to any area of the brain is blocked or interrupted suddenly, the functions controlled by that part of the brain may be diminished or lost completely. The symptoms of a stroke and the aftereffects of stroke vary widely depending on the type of stroke, the area of the brain affected and the extent of injury to the brain.

Brain injury from stroke can cause:

- Difficulty moving or controlling arms and/or legs: a stroke can sometimes cause total or partial paralysis on one or both sides of the body
- Facial droop on one side
- Slurring, difficulty speaking and/or understanding another person
- Blurred vision, double vision or blindness
- Changes in sensation (such as touch or awareness of body positioning)
- Changes in behavior and thought patterns
- Changes in memory and emotions
- Persistent vegetative state (referred to as “Locked-in Syndrome”)
- Death

Skills and functions associated with the different sections of the brain

The brain is divided into four sections, called “lobes”: the frontal lobe, parietal lobe, occipital lobe and temporal lobe. These lobes are associated with a number of different functions from walking to talking.

Some of the specific functions associated with each lobe are listed on the following page.

There are two additional parts of the brain that help control our day-to-day function: the brainstem and the cerebellum.

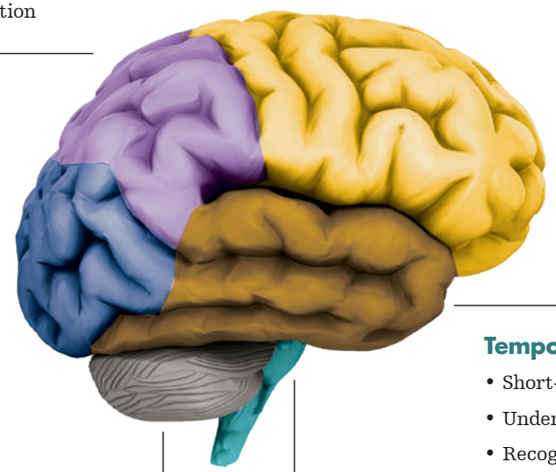
- The brainstem connects the brain to the spinal cord. It controls the passage of information between the brain and the rest of the body. It also controls basic bodily functions such as breathing, swallowing, heart rate, blood pressure, consciousness and whether one is awake or sleepy.
- The cerebellum is the portion of the brain located in the back of the head. It controls voluntary and involuntary movement, as well as balance and eye movement.

Frontal lobe

- Voluntary movement such as lifting your arm
- Ability to focus your attention
- Emotional, social and sexual control
- Ability to speak
- Decision-making

Parietal lobe

- Awareness of body parts
- Academic skills
- Naming objects
- Eye/hand coordination



Occipital lobe

- Ability to see and understand what you are seeing
- Reading

Temporal lobe

- Short-term memory
- Understanding speech
- Recognizing faces
- Behavior

Brainstem

Cerebellum

What are the **risk factors for stroke?**

A risk factor is something that can increase your chance of getting a disease. There are two types of risk factors. Hereditary risk factors cannot be changed because you are born with them. Lifestyle-related risk factors can be modified and you should talk with your doctor about how to reduce your risk.

Even if you feel healthy, it's possible to have multiple risk factors for stroke. Because many risk factors don't show symptoms, you should talk with your doctor to understand your risk and how to reduce it.

Hereditary risk factors

- Increasing age
- Gender
- Race and ethnicity
- Family history of stroke
- Prior Transient Ischemic Attack (TIA – this means you have had a previous "mini" or "warning" acute ischemic stroke)
- Prior acute ischemic stroke
- Prior heart attack

Lifestyle risk factors[1]

- High blood pressure
- High cholesterol
- Smoking/tobacco use
- Alcohol and illegal drug use
- Diabetes
- Physical inactivity or obesity
- Unhealthy diet
- Stress and depression
- Atrial fibrillation ("a-fib" is a common type of abnormal heartbeat where the heart beats fast and irregular) or other heart disease
- Brain aneurysm or AVM
- Carotid artery stenosis (meaning your artery is narrowed) or other cardiovascular disease
- End-stage renal disease or chronic kidney disease

What are the **warning signs and symptoms for stroke?**

Many people don't recognize the signs of a stroke. Knowing them can help you react fast and seek immediate medical attention. Quick action may reduce the effects of a stroke or save someone's life.

Stroke symptoms depend on the type of stroke (hemorrhagic or ischemic) and the area of the brain that is affected. The length and severity of symptoms can vary drastically from person to person. Although other diseases or conditions may have similar symptoms as stroke, **sudden onset** is a key factor. The most common symptoms of stroke are:

- Numbness or weakness of the face, arm or leg – often only on one side of the body
- Difficulty speaking
- Difficulty understanding
- Sudden changes in behavior
- Short-term memory loss
- Blurred vision or trouble seeing in one or both eyes
- Dizziness, extreme fatigue, confusion or loss of balance and coordination
- Dilated pupils or sensitivity to light
- Sudden or extremely severe headache, often described as "the worst headache of one's life"

If you notice any of these symptoms, call your emergency medical service provider and ask the driver to take the person to a certified stroke center in the area. Do NOT attempt to transport the person to the hospital on your own. Hospitals can vary widely in their ability to recognize and provide intervention for acute ischemic stroke.

Recognize the signs of stroke by acting F.A.S.T.

Face:

Check for facial droop on one side or an uneven smile.

Arm:

Ask the person to raise both arms at the same time. Notice if one arm lags behind or is not raised as high as the opposite arm. Also check to see if the person is unable to keep both arms at equal height for several seconds.

Speech:

Ask the person to repeat a simple sentence, such as "The cow jumped over the moon." Listen for slurred speech, inability to repeat the sentence or if the person is having difficulty understanding.

Time:

Call Emergency Services.

Any one of these signs may indicate an acute ischemic stroke. If the person exhibits one or more of these signs, call Emergency Services immediately.

Treatment options for stroke

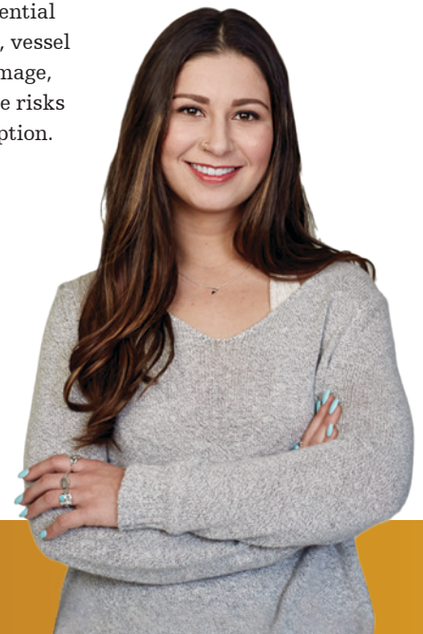
Stroke generally happens suddenly and medical care needs to be administered as quickly as possible. It is not only important to recognize the signs and symptoms of stroke, but to also know the available treatment options and the hospitals that have the capability to perform these procedures.

Three methods of treating stroke

The physician will determine the best course of treatment depending on the type of stroke, the patient's age, the severity of the stroke and other risk factors.

As with any medical procedure or intervention, there are potential risks involved in treating strokes. This may include infection, vessel perforation with or without bleeding, vessel dissection or damage, death, among others. The physician will be able to explain the risks and benefits associated with their recommended treatment option.

"For every 30 minutes that there is a delay in removing the blood clot, the probability of a good clinical outcome decreases by 12%."[3]



Nora, age 19
Stroke survivor treated with the Trevo Retriever

Treatment options for ischemic stroke

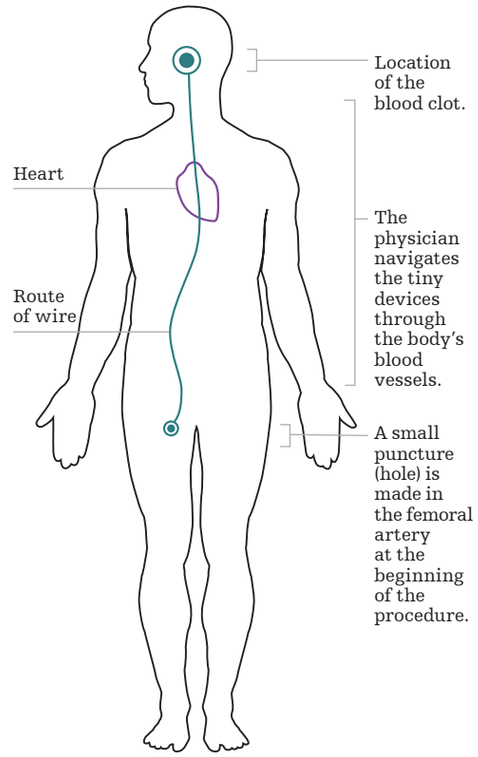
In acute ischemic stroke, the blockage of blood flow is usually caused by a blood clot. The goal in treating acute ischemic stroke is to restore the flow of blood to the parts of the brain affected by the stroke by dissolving the clot, removing the clot or by otherwise resolving the blockage. Based on the patient's symptoms, the blockage location and other diagnostic testing, the treating physician will determine the most appropriate method of care.

Lytic or "clot busting" drugs

If diagnosis of an acute ischemic stroke occurs within the first three hours from the onset of symptoms, the treating physician may administer Activase® (alteplase), also referred to as tPA (tissue Plasminogen Activator).

Activase is the brand name of a drug type called a lytic or "clot buster." It is generally administered intravenously (through a vein in the arm). The drug works by traveling through the body to the clot and breaking it apart.

The path of endovascular treatment



Some patients may not be eligible for tPA due to serious illness, recent surgery, clotting disorders or other conditions. And unfortunately, since most patients do not reach the hospital within the first three hours, few receive this treatment. In these cases, other medical intervention may be necessary.

How effective are lytics?

If the clot is of average or small size, the drug may be successful in dissolving it completely. In ischemic strokes involving the larger arteries in the brain, the size of the clot (referred to as "clot burden") may be too big for the drug to be effective, and the patient may require additional intervention. A recent clinical trial showed that in patients who had an ischemic stroke in the large arteries in the brain, only 19% of patients were able to live independently 90 days after treatment with lytic therapy.[4]

Endovascular clot removal

Your physician may recommend endovascular clot removal, a minimally invasive surgical procedure that involves the physician navigating tiny FDA-cleared medical devices to the brain to try to remove the blockage. This type of procedure is considered the new standard of care for patients with a large artery occlusion in the brain, holding Class 1, Level A evidence from the American Heart Association. The procedure may be done with the patient either awake or asleep.

One device a physician may use is the Trevo Retriever, a tiny stent-like retrieval device attached to a wire.

The physician navigates the retriever from the femoral artery (located in the upper leg) to the blocked artery in the brain. The retriever is positioned in the clot and is designed to grab onto the clot. The physician removes the retriever and clot from the body using the attached wire.

The Trevo Retriever has been extensively studied in a number of clinical trials. It has been used up to 24 hours after the start of symptoms, based on the physician's discretion. While a growing number of hospitals offer endovascular clot retrieval, it is not available everywhere.

Figure 1.
The physician navigates the retriever from the femoral artery in the upper leg to the affected artery in the brain.

Figure 2.
The retriever integrates into the clot.

Figure 3.
The retriever and blood clot are removed from the body, restoring blood flow to the brain.

How effective is the Trevo Retriever?

Removing the blood clot and restoring blood flow to the brain is the main goal when treating ischemic stroke patients. The Trevo Retriever has been studied in more than 2,500 patients worldwide[5] and has been proven to reduce disability up to 24 hours from when symptoms start.[6] A recent study showed that it removes clot 9 out of 10 times.[7] In a recent study called the DAWN Trial, nearly 50% of patients were able to live independently with minimal to no disability 90 days after their stroke.[8]

Treatment options for aneurysms

Not all aneurysms need to be treated. A physician may elect to simply observe the aneurysm over time. However, if an aneurysm is the cause of a hemorrhagic stroke, the physician may recommend immediate surgical clipping or endovascular coil embolization. If an aneurysm has not burst, but your physician feels that it may be at risk of bursting, he may recommend clipping, coiling or placement of a flow-diverting stent. The physician will discuss these options with you and recommend the best course of action based on age, risk factors, size of the aneurysm and overall health.

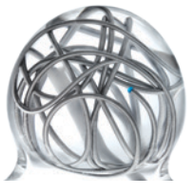
The goal of aneurysm treatment is to prevent the aneurysm from bursting or to prevent re-bleeding by sealing off the aneurysm from the artery out of which it grew.

Surgical clipping

In this type of procedure, the physician accesses the brain through the skull and locates the blood vessel with the aneurysm. A metal clip is then placed across the base of the aneurysm where it comes off of the artery. This clip cuts off the blood flow into the aneurysm, thereby minimizing the risk that the aneurysm could burst in the future. Proceeding with this surgery depends on the location and size of the aneurysm, as well as the overall health of the patient.

Endovascular coil embolization

Endovascular coiling is a minimally invasive procedure during which a small incision is made in the groin and small tubes and wires are navigated through the blood vessels to the aneurysm in the brain. Tiny, soft metal coils are then pushed through the tube and placed into the aneurysm. These coils compact to create a tiny metal ball that helps prevent blood flow from entering the aneurysm, thereby relieving the pressure pushing against the walls of the aneurysm.

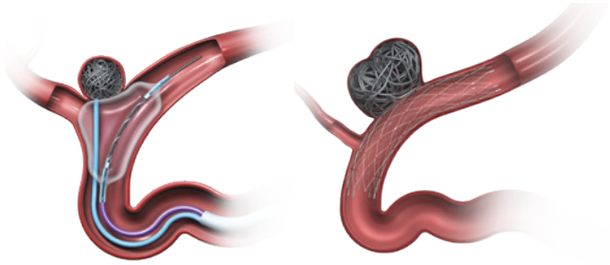


Coils entering the aneurysm

Coils filling empty space within the aneurysm

Aneurysm packed with coils

The Target Detachable Coil is the world's leading coil, and is offered in a wide variety of sizes. The physician will determine the appropriate size and number of coils needed for a given aneurysm. Due largely to superior clinical outcomes and the elimination of a very invasive procedure with surgical clipping, endovascular coiling has replaced surgical clipping as the standard of care for the treatment of many brain aneurysms.



Balloon-assisted coiling

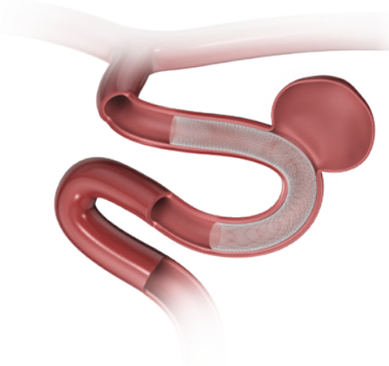
Stent-assisted coiling

In aneurysms with large openings from the artery (known as "wide-neck" aneurysms), the physician may elect to use additional devices such as a metal stent (a tiny hollow metal tube with holes in it that acts as a scaffold within the vessel) or a balloon. These devices are designed to help to keep the coils in place inside the aneurysm. In stent-assisted coiling, a permanent stent is placed in the artery where the aneurysm branches off of to help keep the coils in place. Balloon-assisted coiling involves temporarily placing a removable balloon where the aneurysm branches off of the artery in order to help keep the coils in place.

In 2002, a landmark study was published comparing coiling versus clipping of ruptured aneurysms. The trial concluded that coiling was superior to clipping of ruptured aneurysms by 23.9%.[9]

Endovascular flow-diverting stent placement

Endovascular flow-diverting stent placement is a minimally invasive procedure. Typical neurovascular stents that are used in stent-assisted coiling (see Endovascular Coil Embolization) are tiny, hollow metal tubes with holes in them that act as a scaffold within the vessel. Flow-diverting stents are more mesh-like, with much smaller holes. This type of stent is designed to minimize or redirect blood flow away from the aneurysm, potentially reducing the risk of the aneurysm bursting.



Flow-diverting stents are an alternative to coiling for treating unruptured aneurysms. The physician will determine the best course of action based on aneurysm size, aneurysm location, patient age and overall patient health.

AVM treatment

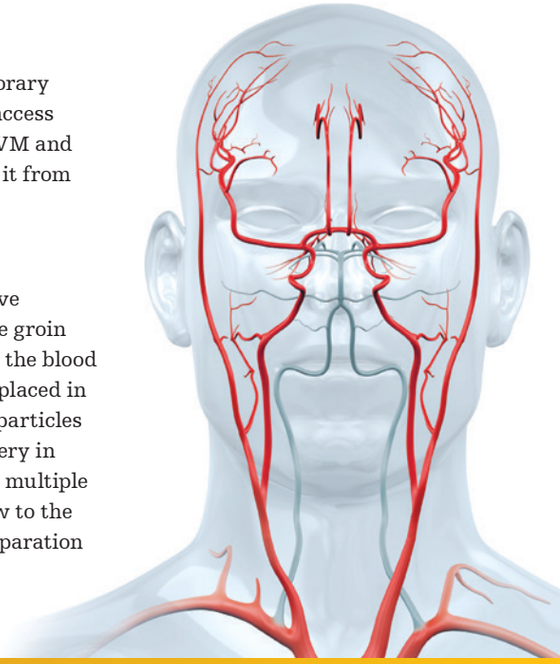
There are several treatment options for brain AVM. The physician will determine the best course of action based on the size, location of the AVM and overall patient health. In general, these treatments aim to lower the risk of bleeding or re-bleeding.

Surgical removal

This is an invasive procedure involving the temporary removal of a section of the skull in order to gain access to the AVM. The neurosurgeon then locates the AVM and uses special clips to seal off the AVM and remove it from surrounding brain tissue.

Endovascular embolization

Endovascular embolization is a minimally invasive procedure whereby a small incision is made in the groin and small tubes and wires are navigated through the blood vessels to the AVM in the brain. The tube is then placed in one of the feeding arteries to the AVM and small particles with glue-like properties are injected into the artery in order to block the vessel. This may be repeated in multiple feeder vessels with the goal of reducing blood flow to the AVM. This procedure may be done alone or in preparation for surgical removal.



Preventing **another stroke**

One in every four individuals who suffer a stroke will have a secondary or recurrent stroke.[10] Taking steps toward a healthier lifestyle can play a major role in decreasing your risk of having a stroke in the future.

Some things you can do immediately include the following:[11]

- Stop smoking
- Engage in physical activity on a regular basis – consult with your physician to determine what is best for you
- Maintain a healthy weight
- Eat a healthy diet – this includes a low-sodium diet if you have high blood pressure
- Maintain a healthy blood pressure or work with your doctor to control high blood pressure
- If you have a heart condition, including valve disease or irregular heartbeat (known as atrial fibrillation or "a-fib"), work with your physician to monitor and control it
- Take your medication as prescribed by your physician

What resources are available for stroke patients and their caregivers?

There are many stroke-related websites offering resources such as support groups, stroke hotlines, discussion boards, magazines and other literature for stroke survivors and caregivers.

While these resources can be helpful, it is very important to consult with your healthcare provider to understand any possible long-term disabilities and ensure the best post-stroke care.

Glossary

Aneurysm – (n.) A ballooning or bulging of a blood vessel resembling a berry on a stick. Can occur in any part of the body; however, brain aneurysms are considered the most life-threatening.

Aneurysm clipping – (n.) An invasive form of surgery for treating a brain aneurysm whereby a metal clip is placed along the neck of the aneurysm.

Angiography – (n.) An X-ray of the blood vessels after injection of contrast (a radiopaque substance that appears on X-ray). This test allows a physician to visualize the vessels of the brain to determine the best method of treatment (syn: arteriography, angiogram, arteriogram).

Artery – (n.) A blood vessel which brings blood with oxygen and nutrients from the heart to blood vessel.

AVM – (n.) Stands for arteriovenous malformation. This is a condition where the connections between arteries and veins is abnormal – often resembling a tangled web.

Cerebrovascular Accident (CVA) – (n.) A stroke.

Clip – (n.) A tiny, metal device that is typically placed along the neck of an aneurysm, thereby blocking blood flow from the blood vessel into the aneurysm.

Clot – (n.) A coagulated mass of blood.

Clot buster – See Lytic.

Coil – (n.) A tiny, thin, soft metal device – resembling string – that is placed in an aneurysm during a coil embolization procedure.

Embolus – (n.) An abnormal particle, such as a clot, circulating in the blood vessels. An embolus may cause a stroke if it becomes lodged in a brain vessel and disrupts normal flow of blood.

Endovascular – (n.) Inside the blood vessels.

Endovascular clot removal – (n.) A minimally invasive surgical procedure whereby a physician attempts to remove a blood clot that is blocking blood flow to an area or areas of the brain. See also Endovascular or Trevo Retriever.

Endovascular coil embolization – (n.) A minimally invasive form of surgery for treating a brain aneurysm whereby a physician places tiny coils into an aneurysm in the brain. See also Coil.

Involuntary functions – (adj.) Bodily activities that are not within our conscious control. For example, the movement of the muscles in our chest when we breathe is involuntary.

Ischemia – (n.) Deficient supply of blood and oxygen to a body part such as the heart or brain. Ischemia may be due to obstruction of the inflow of arterial blood. The obstruction may be caused by a clot, the narrowing of arteries, spasm or disease.

Ischemic – (adj.) Describing a type of condition in which oxygen is deficient.

Lytic – (n.) A genre of drugs (such as streptokinase, Activase or tissue plasminogen activator) used to dissolve blood clots. Also known as “clot busting” drugs.

Stent – (n.) A tiny hollow metal tube with holes in it that acts as a scaffold within a blood vessel.

Stroke – (n.) The sudden loss of sensation, voluntary motion or other functions caused by rupture or obstruction of a blood vessel of the brain. Also called a brain attack or cerebrovascular accident.

Hemorrhagic stroke – (n.) Stroke caused by the rupture of a blood vessel that results in bleeding into the tissue of the brain.

Ischemic stroke – (n.) Stroke caused by a clot (thrombus or embolus).

Thrombus – (n.) Blood clot that accumulates in a blood vessel. If a thrombus becomes dislodged and circulates, it is called an embolus.

Transient Ischemic Attack (TIA) – (n.) A brief episode of cerebral ischemia that is usually characterized by temporary blurring of vision, slurring of speech, numbness, paralysis, or syncope (fainting). TIA is often predictive of a serious stroke. Also called a mini-stroke.

Trevo Retriever – (n.) A tiny metal device attached to a wire that is delivered to the affected blood vessels in the brain. It is designed to restore blood flow in the brain by removing clots in patients experiencing an ischemic stroke.

Vein – (n.) A blood vessel which brings blood without oxygen and nutrients back to the heart to be replenished.

Voluntary functions – (adj.) Movements that are performed under a person’s conscious control. For example, moving a hand to scratch an itch is a voluntary movement.

Bibliography

1 American Heart Association. Heart Disease and Stroke Statistics —2018 Update. Dallas, Texas: American Heart Association; 2018. ©2018, American Heart Association.

2 Brain Aneurysm Foundation. www.bafound.org/about-brain-aneurysms/brain-aneurysm-basics/brain-aneurysm-statistics-and-facts/. Accessed May 2, 2018.

3 Khatri P., Yeatts S. D., Mazighi M., Broderick J. P., Liebeskind D. S., Demchuk A. M., et al. 2014. Time to angiographic reperfusion and clinical outcome after acute ischaemic stroke: an analysis of data from the Interventional Management of Stroke (IMS III) phase 3 trial. Lancet Neurol.13:567-574.

4 O.A. Berkhemer et. al. A Randomized Trial for Intraarterial Treatment for Acute Ischemic Stroke. N Eng J Med 2014.

5 Includes Trevo 2000 Registry (n=2,010), TREVO (n=60), TREVO 2 (n=83), TRACK Registry (n=629), DAWN™ Trial (n=107).

6 Full FDA indication for Trevo Retriever.

7 Interim results of the Trevo 2000 Registry, presented at SNIS 2017 in Colorado Springs, Colorado. 93% TICI 2b/3 rate.

8 Nogueira RG, Jadhav AP, Haussen DC, et al. Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct. N Eng J Med. 2018;378:11-21.

9 Molyneux AJ, et al. International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion. Lancet. 2005 Sep 3-9;366(9488):809-17.

10 National Stroke Association. www.stroke.org/we-can-help/survivors/stroke-recovery/first-steps-recovery/preventing-another-stroke. Accessed May 2, 2018.

11 Fact Sheet. www.stroke.org http://www.stroke.org/site/DocServer/Secondary_Stroke_Fact_Sheet.doc?docID=762

Target Detachable Coil

See package insert for complete indications, contraindications, warnings and instructions for use.

Intended use / indications for use

Target Detachable Coils are intended to endovascularly obstruct or occlude blood flow in vascular abnormalities of the neurovascular and peripheral vessels.

Target Detachable Coils are indicated for endovascular embolization of:

- Intracranial aneurysms
- Other neurovascular abnormalities such as arteriovenous malformations and arteriovenous fistulae
- Arterial and venous embolizations in the peripheral vasculature

Contraindications

None known.

Potential adverse events

Potential complications include, but are not limited to: allergic reaction, aneurysm perforation and rupture, arrhythmia, death, edema, embolus, headache, hemorrhage, infection, ischemia, neurological/intracranial sequelae, post-embolization syndrome (fever, increased white blood cell count, discomfort), TIA/stroke, vasospasm, vessel occlusion or closure, vessel perforation, dissection, trauma or damage, vessel rupture, vessel thrombosis. Other procedural complications including but not limited to: anesthetic and contrast media risks, hypotension, hypertension, access site complications.

Warnings

- Contents supplied STERILE using an ethylene oxide (EO) process. Do not use if sterile barrier is damaged. If damage is found, call your Stryker Neurovascular representative.
- For single use only. Do not reuse, reprocess or resterilize. Reuse, reprocessing or resterilization may compromise the structural integrity of the device and/or lead to device failure which, in turn, may result in patient injury, illness or death. Reuse, reprocessing or resterilization may also create a risk of contamination of the device and/or cause patient infection or cross-infection, including, but not limited to, the transmission of infectious disease(s) from one patient to another. Contamination of the device may lead to injury, illness or death of the patient.
- After use, dispose of product and packaging in accordance with hospital, administrative and/or local government policy.
- **This device should only be used by physicians who have received appropriate training in interventional neuroradiology or interventional radiology and preclinical training on the use of this device as established by Stryker Neurovascular.**
- Patients with hypersensitivity to 316LVM stainless steel may suffer an allergic reaction to this implant.
- MR temperature testing was not conducted in arteriovenous malformations or fistulae models.
- The safety and performance characteristics of the Target Detachable Coil System (Target Detachable Coils, InZone Detachment Systems, delivery systems and accessories) have not been demonstrated with other manufacturer's devices (whether coils, coil delivery devices, coil detachment systems, catheters, guidewires, and/or other accessories). Due to the potential incompatibility of non Stryker Neurovascular devices with the Target Detachable Coil System, the use of other manufacturer's device(s) with the Target Detachable Coil System is not recommended.
- To reduce risk of coil migration, the diameter of the first and second coil should never be less than the width of the ostium.
- In order to achieve optimal performance of the Target Detachable Coil System and to reduce the risk of thromboembolic complications, it is critical that a continuous infusion of appropriate flush solution be maintained between a) the femoral sheath and guiding catheter, b) the 2-tip microcatheter and guiding catheter, and c) the 2-tip microcatheter and Stryker Neurovascular guidewire and delivery wire. Continuous flush also reduces the potential for thrombus formation on, and crystallization of infusate around, the detachment zone of the Target Detachable Coil.
- Do not use the product after the "Use By" date specified on the package.
- Reuse of the packaging hoop or use with any coil other than the original coil may result in contamination of, or damage to, the coil.

Damaged delivery wires may cause detachment failures, vessel injury or unpredictable distal tip response during coil deployment. If a delivery wire is damaged at any point during the procedure, do not attempt to straighten or otherwise repair it. Do not proceed with deployment or detachment. Remove the entire coil and replace with undamaged product.

- Utilization of damaged coils may affect coil delivery to, and stability inside, the vessel or aneurysm, possibly resulting in coil migration and/or stretching.
- The fluoro-saver marker is designed for use with a Rotating Hemostatic Valve (RHV). If used without an RHV, the distal end of the coil may be beyond the alignment marker when the fluoro-saver marker reaches the microcatheter hub.
- If the fluoro-saver marker is not visible, do not advance the coil without fluoroscopy.
- Do not rotate delivery wire during or after delivery of the coil. Rotating the Target Detachable Coil delivery wire may result in a stretched coil or premature detachment of the coil from the delivery wire, which could result in coil migration.
- Verify there is no coil loop protrusion into the parent vessel after coil placement and prior to coil detachment. Coil loop protrusion after coil placement may result in thromboembolic events if the coil is detached.
- Verify there is no movement of the coil after coil placement and prior to coil detachment. Movement of the coil after coil placement may indicate that the coil could migrate once it is detached.
- Failure to properly close the RHV compression fitting over the delivery wire before attaching the InZone Detachment System could result in coil movement, aneurysm rupture or vessel perforation.
- Verify repeatedly that the distal shaft of the catheter is not under stress before detaching the Target Detachable Coil. Axial compression or tension forces could be stored in the 2-tip microcatheter causing the tip to move during coil delivery. Microcatheter tip movement could cause the aneurysm or vessel to rupture.
- Advancing the delivery wire beyond the microcatheter tip once the coil has been detached involves risk of

aneurysm or vessel perforation.

- The long term effect of this product on extravascular tissues has not been established so care should be taken to retain this device in the intravascular space.

Cautions / precautions

- Federal Law (USA) restricts this device to sale by or on the order of a physician.
- Besides the number of InZone Detachment System units needed to complete the case, there must be an extra InZone Detachment System unit as back up.
- Removing the delivery wire without grasping the introducer sheath and delivery wire together may result in the detachable coil sliding out of the introducer sheath.
- Failure to remove the introducer sheath after inserting the delivery wire into the RHV of the microcatheter will interrupt normal infusion of flush solution and allow back flow of blood into the microcatheter.
- Some low level overhead light near or adjacent to the patient is required to visualize the fluoro-saver marker; monitor light alone will not allow sufficient visualization of the fluoro-saver marker.
- Advance and retract the Target Detachable Coil carefully and smoothly without excessive force. If unusual friction is noticed, slowly withdraw the Target Detachable Coil and examine for damage. If damage is present, remove and use a new Target Detachable Coil. If friction or resistance is still noted, carefully remove the Target Detachable Coil and microcatheter and examine the microcatheter for damage.
- If it is necessary to reposition the Target Detachable Coil, verify under fluoroscopy that the coil moves with a one-to-one motion. If the coil does not move with a one-to-one motion or movement is difficult, the coil may have stretched and could possibly migrate or break. Gently remove both the coil and microcatheter and replace with new devices.
- Increased detachment times may occur when:
  - Other embolic agents are present.
  - Delivery wire and microcatheter markers are not properly aligned.
  - Thrombus is present on the coil detachment zone.
- Do not use detachment systems other than the InZone Detachment System.

Trevo XP ProVue Retrievers

See package insert for complete indications, complications, warnings, and instructions for use.

Intended use / indications for use

1. The Trevo Retriever is indicated for use to restore blood flow in the neurovasculature by removing thrombus for the treatment of acute ischemic stroke to reduce disability in patients with a persistent, proximal anterior circulation, large vessel occlusion, and smaller core infarcts who have first received intravenous tissue plasminogen activator (IV t-PA). Endovascular therapy with the device should start within 6 hours of symptom onset.
2. The Trevo Retriever is intended to restore blood flow in the neurovasculature by removing thrombus in patients experiencing ischemic stroke within 8 hours of symptom onset. Patients who are ineligible for intravenous tissue plasminogen activator (IV t-PA) or who fail IV t-PA therapy are candidates for treatment.
3. The Trevo Retriever is indicated for use to restore blood flow in the neurovasculature by removing thrombus for the treatment of acute ischemic stroke to reduce disability in patients with a persistent, proximal anterior circulation, large vessel occlusion of the internal carotid artery (ICA) or middle cerebral artery (MCA)-M1 segments with smaller core infarcts (0-50cc for age <80 years, 0-20cc for age ≥80 years). Endovascular therapy with the device should start within 6-24 hours of time last seen well in patients who are ineligible for intravenous tissue plasminogen activator (IV t-PA) or who fail IV t-PA therapy.

Complications

Procedures requiring percutaneous catheter introduction should not be attempted by physicians unfamiliar with possible complications which may occur during or after the procedure. Possible complications include, but are not limited to, the following: air embolism, hematoma or hemorrhage at puncture site, infection, distal embolization, pain/headache, vessel spasm, thrombosis, dissection, perforation, emboli, acute occlusion, ischemia, intracranial hemorrhage, false aneurysm formation, neurological deficits including stroke, death.

Specific warnings for indication 1

- The safety and effectiveness of the Trevo Retrievers in reducing disability has not been established in patients with large core infarcts (i.e., ASPECTS ≤ 7). There may be increased risks, such as intracerebral hemorrhage, in these patients.
- The safety and effectiveness of the Trevo Retrievers in reducing disability has not been established or evaluated in patients with occlusions in the posterior circulation (e.g., basilar or vertebral arteries) or for more distal occlusions in the anterior circulation.

Specific warnings for indication 2

- To reduce risk of vessel damage, take care to appropriately size Retriever to vessel diameter at intended site of deployment.

Specific warnings for indication 3

- The safety and effectiveness of the Trevo Retrievers in reducing disability has not been established in patients with large core infarcts (i.e., ASPECTS ≤ 7). There may be increased risks, such as intracerebral hemorrhage, in these patients.
- The safety and effectiveness of the Trevo Retrievers in reducing disability has not been established or evaluated in patients with occlusions in the posterior circulation (e.g., basilar or vertebral arteries) or for more distal occlusions in the anterior circulation.
- Users should validate their imaging software analysis techniques to ensure robust and consistent results for assessing core infarct size.

General warnings applied to all indications

- Administration of IV t-PA should be within the FDA-approved window (within 3 hours of stroke symptom onset). To reduce risk of vessel damage, adhere to the following recommendations:
  - Do not perform more than six (6) retrieval attempts in same vessel using Retriever devices.
  - Maintain Retriever position in vessel when removing or exchanging Microcatheter.
- To reduce risk of kinking/fracture, adhere to the following recommendations:
  - Immediately after unsheathing Retriever, position Microcatheter or Aspiration Catheter tip marker over the proximal section of the Retriever. Maintain this position during manipulation and withdrawal.
  - Do not rotate or torque Retriever.
  - Use caution when passing Retriever through stented arteries
- The Retriever is a delicate instrument and should be handled carefully. Before use and when possible during procedure, inspect device carefully for damage. Do not use a device that shows signs of damage. Damage may prevent device from functioning and may cause complications.
- Do not advance or withdraw Retriever against resistance or significant vasospasm. Moving or torqueing device against resistance or significant vasospasm may result in damage to vessel or device. Assess cause of resistance using fluoroscopy and if needed resheath the device to withdraw.
- If Retriever is difficult to withdraw from the vessel, do not torque Retriever. Advance Microcatheter or Aspiration Catheter over the Retriever and remove devices as a unit. If undue resistance is met when withdrawing the Retriever into the Microcatheter, consider extending the Retriever using the Abbott Vascular DOC guidewire extension (REF 22260) so that the Microcatheter can be exchanged for a larger diameter Aspiration Catheter. Gently withdraw the Retriever and larger diameter catheter as a unit.
- Administer anti-coagulation and anti-platelet medications per standard institutional guidelines.
- Do not use open or damaged packages.
- Do not expose Retriever to solvents.
- Do not attach a torque device to the shaped proximal end of DOC Compatible Retriever. Damage may occur, preventing ability to attach DOC Guide Wire Extension.

Precautions

- Store in cool, dry, dark place.
- Use by "Use By" date.
- Exposure to temperatures above 54°C (130°F) may damage device and accessories. Do not autoclave.
- Use Retriever in conjunction with fluoroscopic visualization and proper anti-coagulation agents.
- To prevent thrombus formation and contrast media crystal formation, maintain a constant infusion of appropriate flush solution through all catheter lumens.

- Users should take all necessary precautions to limit X-radiation doses to patients and themselves by using sufficient shielding, reducing fluoroscopy times, and modifying X-ray technical factors where possible.

This document is intended solely for the use of healthcare professionals.

A physician must always rely on his or her own professional clinical judgment when deciding whether to use a particular product when treating a particular patient. Stryker does not dispense medical advice and recommends that physicians be trained in the use of any particular product before using it in a procedure. The information presented is intended to demonstrate the breadth of Stryker product offerings. A physician must always refer to the package insert, product label and/or instructions for use before using any Stryker product. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your Stryker representative if you have questions about the availability of Stryker products in your area.

AUS **Australian Sponsor Address**
Stryker Australia Pty Ltd
8 Herbert Street
St Leonards, NSW 2065
Australia

Stryker Neurovascular
47900 Bayside Parkway
Fremont, CA 94538

strykerneurovascular.com

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