

Aneurysm Clipping

Information for patients

Clipping is a surgical procedure used to treat an aneurysm, which is balloon-like bulge of an artery wall. As an aneurysm grows it becomes thinner and weaker. It can become so thin that it leaks or ruptures and releases blood into the spaces round the brain – called a subarachnoid haemorrhage (SAH). A neurosurgeon places a tiny clip across the neck of the aneurysm to stop, or prevent, it from bleeding.

What is aneurysm clipping?

Surgical clipping is used to separate an aneurysm from normal circulation without blocking any nearby small arteries. Under anaesthetic an opening, called a craniotomy, is made in the skull and the brain is gently opened to find the aneurysm. A small clip is placed across the base, or neck, of the aneurysm to block the normal blood flow. The clip works like a tiny coil-spring clothes peg and the blades of the clip stay tightly closed until pressure is applied to open the blades. Clips are made of titanium and stay on the artery permanently.

Aneurysms vary in their size and shape. Saccular (sac-like) aneurysms have a neck at their base on the main artery and a dome that can expand and grow like a balloon (Fig 1). Some aneurysms have a wide neck or fusiform, in shape without a definable neck. These are more difficult to clip. As aneurysms have various necks, clips are made in a variety of shapes, sizes and length (Fig 2).

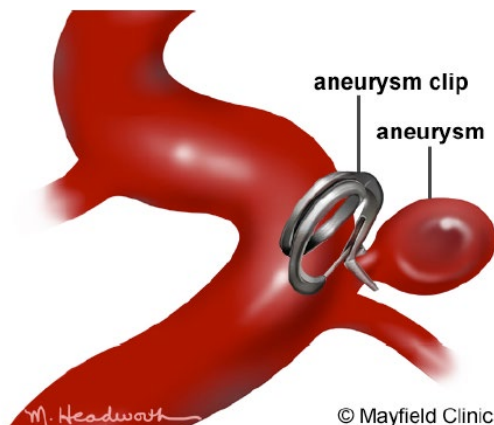


Figure 1. Most aneurysms resemble a balloon, with a narrow neck at its origin and a large expanding dome. Typically, a clip is placed across the neck of the aneurysm to prevent blood flow from entering the dome.

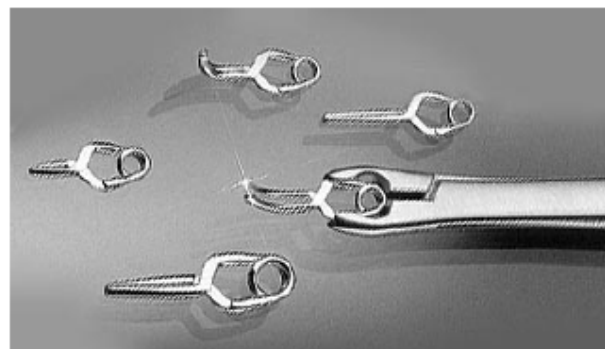


Figure 2. Aneurysm clips come in a variety of sizes and curves. A clip applicator opens the blades of the aneurysm clip.

Who can be treated?

The choice of treatment (observation, surgical clipping, or coiling) must be weighed against the risk of rupture and patient's health. Because clipping involves an anaesthetic and surgically entering the skull, patients with other health conditions may be treated with observation and coiling.

Clipping may be an effective treatment for the following:

- **Ruptured aneurysms** burst open and release blood into the space between the brain and skull (SAH). The risk of repeated bleeding is 35% within the first 14 days after the first bleed. Timing of surgery is important – usually within 72 hours of the first bleed. Vasospasm is a common complication of SAH, which must be closely managed after treatment to prevent a stroke.
- **Unruptured aneurysms** may not cause symptoms and are usually found during routine testing. People with a family history of brain aneurysms should have a screening test (CT or MR angiogram). The risk of aneurysm rupture is about 1% per year but may vary depending on the size and location of the aneurysm. When a rupture occurs the risk of death is 40% and risk of disability is 80%.

The surgical decision

The treatment decision depends on the aneurysm's size, location and neck. Coiling is preferred in the majority of patients, but when the neck makes this difficult, and unlikely to prevent long-term protection from bleeding, clipping is used.

Who performs the treatment?

Surgical clipping is done by a neurosurgeon with specialized training in cerebrovascular (brain and vein) surgery.

What happens before surgery?

Preparation before surgery differs if you are brought into Accident & Emergency with a ruptured aneurysm or if you are having clipping for an unruptured aneurysm.

- **Ruptured aneurysm** is life threatening – you may be taken urgently to the operating theatre
- **Unruptured aneurysm** – you will be booked in for presurgical tests (e.g. blood tests, electrocardiogram, chest X-ray) several days before surgery. In the pre-admission clinic you will fill out paperwork, and sign consent forms, so that your doctors know your medical history (e.g. allergies, medicines, previous operations). You should stop taking non-steroidal anti-inflammatory medicines, antiplatelet medications and aspirin one week before surgery. Patients are admitted to the hospital the morning of the procedure. No food or drink is allowed after midnight the night before surgery. An intravenous line is placed in your arm. The effects and risks of anesthesia will be explained.

What happens during surgery?

There are six steps to the procedure and it usually takes 3-5 hours or longer if a complex operation is planned.

Step 1: prepare the patient

You will lie on the operating table and be given a general anaesthetic. After you are asleep, your head is placed in a three-pin skull fixation device, which attaches to the table and holds your head in place. The incision area of the scalp is prepared. Skin incisions are usually made behind the hair line. For cosmetic reasons a technique may be used where only ¼-inch area along the incision is shaved although sometimes the whole incision area maybe shaved. A brain relaxing drug may be given.

Step 2: perform a craniotomy

Depending on the location of your aneurysm, a bone flap (craniotomy) will be made in your skull. Ask your surgeon to describe exactly where the skin incision will be made and the bone to be removed.

After your scalp is prepared, the surgeon will make a skin incision to expose the skull. The skin and muscles are lifted off the bone and folded back. Small burr holes are made in the skull with a drill. The holes allow entrance of a special saw call a craniotome and the surgeon cuts an outline of a bone window (Fig 3). The cut bone flap is lifted and removed to expose the protective cover of the brain, called the dura mater. The bone flap is safely stored and replaced at the end of the procedure.

Step 3: expose the aneurysm

The dura is opened and folded back to expose the brain. Retractors are placed on the brain to gently open a corridor between the brain and skull. Working under a microscope, the surgeon finds the artery and follows it to the aneurysm. Before placing the clip, the surgeon controls the blood flow. Handling the aneurysm, especially the dome, can cause rupture. If a rupture occurs during surgery, a temporary clip can be placed across the parent artery to stop the bleeding. Depending on the size and location, control may be obtained at the artery in the neck through a separate incision.

Step 4: insert the clip

When control is obtained, the aneurysm neck is prepared for clipping. Often the aneurysm is held tight by connective tissue and must be freed. Small arteries, called perforators, must be identified. The clip is held open with a clip applicator and placed across the aneurysm neck. When released, the clip closes and pinches off the aneurysm from the artery. Multiple clips may be used.

Step 5: check the clip

The surgeon checks the clip to make sure it is not narrowing the artery or has trapped other arteries. The dome of the aneurysm is punctured with a needle to make sure it is not filling with blood. Intraoperative angiographic testing (ICG) may be used to check blood flow.

Step 6: close the craniotomy

Once the clip is in place the dura is closed with sutures. The bone flap is replaced and secured to the skull with titanium plates and screws. The muscles and skin are sutured (stitched) back together. A turban-like or soft adhesive dressing will be placed over the incision.

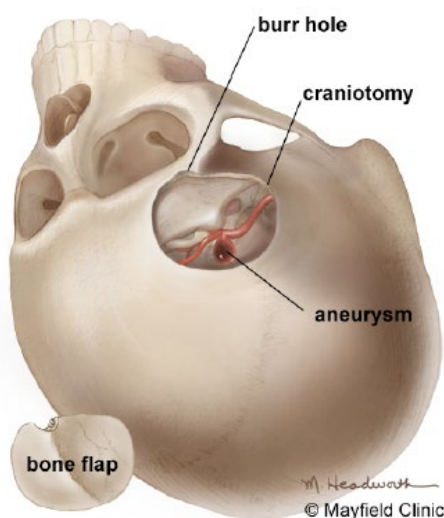


Figure 3. A craniotomy is made in the skull over the area where the aneurysm is located. The bone flap is lifted and temporarily removed.

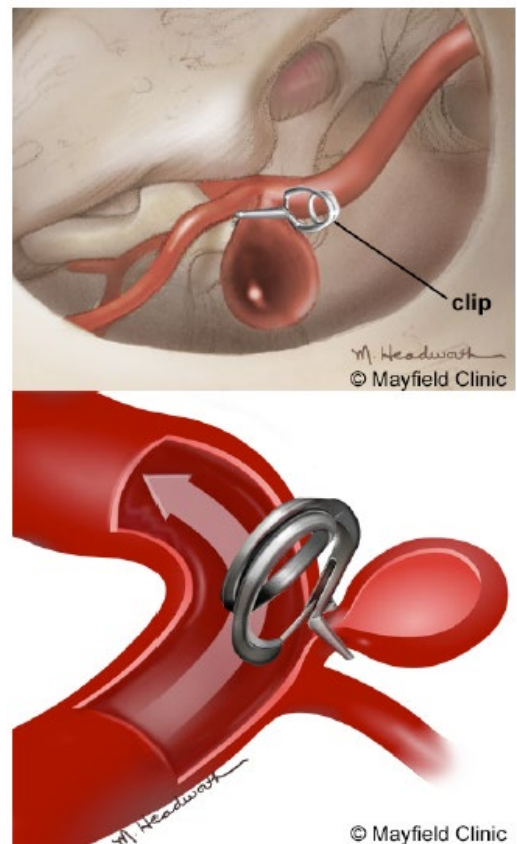


Figure 4. A titanium clip is placed across the neck of an aneurysm preventing blood from entering.

What are the risks?

No surgery is without risk. General complications related to brain surgery include infection, allergic reactions, stroke, seizure and swelling of the brain. Complications specifically related to aneurysm clipping include vasospasm, stroke, seizure, bleeding and an imperfectly based clip.

What are the results?

Aneurysms that are completely clipped have an extremely low risk of regrowth. If the aneurysm has been partially clipped, patients need to have periodic angiograms to make sure that the aneurysm is not growing. Ask your neurosurgeon about follow-up treatments.

Recovery

Aneurysm patients may suffer short-term and/or long-term effects. Some of these may disappear over time with healing and therapy. The recovery process may take months or years to understand the effects and regain function.

Today most aneurysm clips are made of titanium and are not detected by security gates. It is very important to know if your clip is MRI compatible before have an MRI scan. You must check your clip lot number with the manufacturer. You can get the number from your medical notes at the hospital where you had your operation.

Sources and Links

If you have more questions please contact Karen Briggs, Clinical Nurse Specialist, on **0131 312 0863**.

Links

Brain Aneurysm Foundation: www.bafound.org

The Aneurysm and AVM Foundation: www.taafonline.org



Glossary

Aneurysm: a balloon-like bulge or weakening of an artery wall.

Aneurysm clip: a coil spring device used to treat aneurysms.

Angiogram: an X-ray that takes pictures of blood vessels with help of dye injected through a catheter.

Coiling: a procedure to insert platinum coils into an aneurysm; performed during an angiogram.

Craniotome: a surgical saw.

Craniotomy: surgical opening in the skull.

Dura mater: a tough, fibrous, protective covering of the brain.

Embolisation: inserting material, coil or glue, into an aneurysm so blood cannot flow through it.

Subarachnoid hemorrhage (SAH): bleeding in the space surrounding the brain; may cause a stroke.

Titanium: a strong, low-density, highly corrosion-resistant metal alloy.

Vasospasm: abnormal narrowing of arteries due to blood in the subarachnoid space.

The contents of this brochure were created by the Mayfield Clinic where Mr Fouyas received his cerebrovascular training.

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