



Interventional Radiological Treatment of Intracranial (Brain) Aneurysms

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What is an intracranial (brain) aneurysm?

An intracranial (brain) aneurysm is an abnormal ballooning of the wall of an artery, which is a type of blood vessel carrying blood to the brain. The aneurysm is like a small sac and is localised, meaning it is limited to a small area, within the artery. In the brain, these vessels carry blood to the brain at high pressure compared to the lower pressure of the veins that carry the blood back to the heart. The ballooning develops because of a weakness of the artery wall.

Aneurysms can enlarge and compress (apply pressure to) normal structures inside the head. They can also rupture, allowing blood to escape from the blood vessel, under high pressure, into the fluid-containing space around the brain, or even directly into the brain tissue. This can cause a sudden severe headache – typically, but not always, described by people as “the worst headache I have ever had”. Associated with this headache can be neck stiffness and vomiting. There is also a very great sensitivity to light (with normal daylight hurting the eyes) so people with a leaking or ruptured brain aneurysm may prefer to be in a dark room. Less commonly, the aneurysm may press on a nerve inside the head, sometimes causing double vision.

Aneurysms that have not leaked, ruptured, or caused any other problems may also be found unexpectedly if you are having **magnetic resonance imaging (MRI)** or **computed tomography (CT)** scanning of your head for another reason.

There are two parts to the treatment you will receive for a brain aneurysm – an angiogram and endovascular coil placement. These procedures are explained in detail below.

How do I prepare for interventional radiological treatment of intracranial aneurysms?

Aneurysms may be treated after they have ruptured or leaked, as an emergency procedure, or when they have not yet leaked or ruptured, as an elective or non-emergency procedure. The reason for treating them if they have not yet leaked or ruptured is to prevent this happening later. Rupture is a serious complication because about 1 in every 4 people who have a brain aneurysm rupture will die as a result.

Aneurysms can be treated by endovascular coil treatment – placing a small coil or coils inside the aneurysm through a catheter (a thin plastic tube) inside the artery, or the placement of a clip outside the aneurysm. This is performed under surgery which requires part of the skull to be removed to allow the neurosurgeon to get to the aneurysm which is deep in the brain.

Preparation for endovascular coil placement first involves finding the aneurysm and determining its features such as position, shape, size, and the type of vessels leading to the aneurysm. When the aneurysm has not ruptured, tests or scans that will likely have been performed include CT, MRI, and angiograms.

You will usually be placed on aspirin for 3-7 days prior to treatment, and sometimes other drugs aimed at decreasing the likelihood of blood clots forming and causing strokes. **Clopidogrel** (often sold as Plavix) is the other most frequently used drug in combination with aspirin, particularly used if a stent is part of the planned treatment for more complex aneurysms. A stent is a tube inserted into an artery to keep it open and prevent it from becoming blocked.

As the treatment is performed under general anaesthetic, a pre-operative visit with the anaesthetist is important to assess your general health, particularly if you have any heart, lung or kidney problems. You must not eat or drink for at least 8 hours prior to the operation.

What happens during interventional radiological treatment of intracranial aneurysms?

When you arrive in the hospital radiology department you will be given a general anaesthetic and be asleep for the treatment.

You will be lying on a table in the angiography suite, which is a special operating theatre that has X-ray equipment. A radiologist (a specialist doctor) will monitor the procedure using X-rays while treating your aneurysm.

A small intravenous line or catheter (thin plastic tube) is placed in your arm and monitors will be attached to your body to measure blood pressure, heart rate and oxygen level. To outline the vessels more clearly on the X-ray images and opacify the blood vessels (make them no longer transparent), a liquid iodine solution or contrast medium is injected into the artery through the catheter.

The radiologist will place a needle into the artery in your groin and a catheter is inserted from this artery under X-ray control, into the arteries in the neck supplying blood to the brain. Once the aneurysm is located, a smaller tube is passed through the first bigger tube, into the head, and into the aneurysm. A series of platinum coils will then be placed into the aneurysm sac. The radiologist will continue to put more coils into the aneurysm until the aneurysm is completely filled, or no more coils can safely be placed inside the sac. This usually takes 2-3 hours in total.

When the aneurysm is packed with coils the blood flow in the aneurysm will be greatly reduced and over time will be stopped due to a blood clot forming between the coils. This is the desired outcome as aneurysms that do not contain flowing blood will not leak or rupture.

After the treatment you will be taken to the recovery room. When you are fully awake you will usually be transferred to the hospital's neurosurgical high dependency ward for close observation. If your procedure is non-emergency this may be for 1-2 days. If your aneurysm has ruptured and you had emergency treatment, the period of close observation will be longer.

Are there any after effects of interventional radiological treatment of intracranial aneurysms?

Occasionally you may have a headache, which is usually short lived. The needle puncture site in the groin may be swollen and tender.

If you experience anything more than minor discomfort you should promptly return to where you had the treatment done or to your referring doctor to ensure that there are no complications developing, such as infection or more bleeding. Complications that may be associated with treating cerebral (brain) aneurysms are discussed later in this document.

How long does interventional radiological treatment of intracranial aneurysms take?

As aneurysms can range in size from 2mm to more than 25mm, the total time involved in treating the aneurysm will vary significantly. Each coil placed into the aneurysm will take 3-10 minutes, and in some aneurysms more than 20 coils can be required.

The shape of the aneurysm, and the need for additional procedures such as stent placement (a tube inserted into the artery to keep it open and prevent it from becoming blocked) will also have an effect on the time taken for the treatment. In general, the procedure and associated anaesthetic will take between 2-4 hours.

You will be admitted to hospital and remain overnight. Occasionally, longer periods of inpatient care will be required, particularly if intravenous blood thinning agents are needed.

What are the risks of interventional radiological treatment of intracranial aneurysms?

There are significant risks involved in treating brain aneurysms. These are partly dependent upon whether your aneurysm has ruptured and your treatment is an emergency, or your aneurysm is unruptured and you are being treated electively as a non-emergency. Serious complications as outlined below all tend to be more common if you are being treated as an emergency.

There are risks associated with the angiogram itself, that is the preparation and procedure for taking X-ray photographs of the blood vessels, even before treatment of the aneurysm with coils occurs. These risks include:

- Allergy to the iodine contrast medium (see **Iodine-containing contrast medium (ICCM)**).
- Kidney damage by the iodine contrast medium.
- Puncture site problems such as bruising, ongoing bleeding needing treatment, damage to the artery, and infection. Serious complications at the puncture site may result in a trip to the operating theatre to repair the artery and/or drain the haematoma (a blood clot).
- Stroke. A stroke is a sudden failure of some part of brain function and a patient who has had a stroke may notice weakness or numbness of an arm or leg, difficulty with speech, difficulty walking, a droop in one half of the face, or even unconsciousness (coma). This could be temporary (lasting hours) or permanent.

During treatment of the aneurysm similar risks to open surgery exist including:

- Stroke due to blocking of the arteries with the coils or a blood clot.

- Rupture of the aneurysm causing bleeding – usually subarachnoid haemorrhage (bleeding in the membranes or thin layers of tissue that cover the brain).
- Device (coil) malfunction such that coils are displaced into normal arteries or fail to detach and remain in the body.

Death during or after treatment is possible, but is uncommon in aneurysms that have not ruptured. Your doctors will be in the best position to provide an estimate of the likelihood of death or major stroke during the treatment of your particular aneurysm. However, while general statements can be made about risk, this will depend on whether your aneurysm is of higher or lower risk.

About 1 in 200 people die as a result of non-emergency endovascular coil treatment of an uncomplicated, unruptured aneurysm and about 6 in every 200 people or 2-4% of people will have a major stroke as a result of this procedure. The chance of both of these complications is considerably higher if your aneurysm has already ruptured and you are being treated as an emergency.

What are the benefits of interventional radiological treatment of intracranial aneurysms?

If a brain aneurysm ruptures, there is a significant chance of death or major disability (more than 50%), and treating the aneurysm is very important to decrease the chance of the aneurysm bleeding again, and to give the best chance of a good recovery.

If a brain aneurysm is discovered before it starts to bleed, your doctors will discuss the major risks of the aneurysm rupturing or enlarging in the future. Enlargement can cause pressure on the nerves or brain. Treating the aneurysm can avoid enlargement and risks associated with aneurysm rupture, the most important of which are death and disabling stroke (see the section on risk (above) for a description of stroke).

Who does interventional radiological treatment of intracranial aneurysms?

The procedure is performed by interventional neuroradiologists (who are specifically trained in neurointerventional procedures). Less commonly the procedure can be performed by neurologists or neurosurgeons who have undergone specialist neurointerventional training. Often there will be two specialist doctors operating together, particularly in more complex

aneurysms. You will have been referred to the neurointerventional specialist by another doctor – possibly your general practitioner, neurologist, neurosurgeon, or hospital emergency department doctor.

Most centres treating aneurysms have teams of specialists who can jointly discuss the options of surgery and endovascular treatment.

Where is interventional radiological treatment of intracranial aneurysms done?

Intracranial aneurysms are generally treated in large hospitals with a specialist neurosurgical or neurointerventional medical team.

When can I expect the results of interventional radiological treatment of intracranial aneurysms?

The neurointerventional doctor will discuss the results of treatment after the procedure with a family member you nominate, and with you when you have fully recovered from the anaesthetic. You will generally require follow up to ensure that the aneurysm does not recur, or new ones do not develop. This can occur in up to half of aneurysms, depending on the shape and size.

Most centres will perform follow up X-ray imaging approximately 6 months after the treatment. This is done with either MRI or another angiogram. In the past all patients had an angiogram to follow up and ensure the blood flow to the aneurysm has completely stopped. However, increasingly the new and less invasive MRI techniques are being explored. MRI does not carry the same risks as a repeat angiogram and there is no need for general anaesthesia, iodine contrast material, or a catheter (thin plastic tube) to be inserted.

Page last modified on 12/10/2016.

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