

SPECIAL POINTS OF INTEREST:

- People are not born with aneurysms, they develop during life, the risk increasing with age.
- Aneurysms usually cause no symptoms until they rupture.
- The risk of an asymptomatic small aneurysm rupturing is quite small.
- Aneurysm rupture (SAH) is extremely dangerous

INSIDE PAGES:

- Should an aneurysm be treated? 2
- Angiography 2
- Aneurysm surgery 3
- Endovascular treatment 3
- What is best treatment? 3
- Risk factors for SAH & aneurysm screening 4

What is an Aneurysm?

An intracranial aneurysm (often also called “Berry” or “saccular” aneurysm) is a bulge on an artery inside the head. These arteries carry high pressure blood to the brain. They are found in the subarachnoid space, which is the space around the brain and spinal cord that is filled with fluid called cerebrospinal fluid (CSF).

The aneurysms form at weak points in the arteries. This most commonly occurs at branching points under the brain where the 4 main arteries supplying blood to the brain interconnect (this arterial interconnection is called the Circle of Willis).

Although everyone has potential weak-points in these arteries, very few people actually develop aneurysms. Aneurysms are extremely rare in childhood. They are usually found in adults and

are increasingly common with advancing age. They are a little more common in women than men.

About 2% of people will develop



Diagram of an intracranial saccular aneurysm.

an aneurysm in their lifetime, although many aneurysms do not rupture and are unrecognised. 15% of these people with aneurysms have more than one aneurysm.

Aneurysms that have not ruptured usually cause no symptoms at all. Most aneurysms only become apparent when they rupture into the CSF, causing subarachnoid haemorrhage (SAH; see below). Occasionally the dome of an aneurysm is embedded into the overlying brain, and when it ruptures it causes a bleed into the brain rather than the more common SAH. A bleed into the brain often requires urgent surgery to evacuate the clot (clipping the aneurysm at the same time).

An enlarging unruptured aneurysm can also occasionally press on a nerve causing problems such as double vision or even visual loss in one eye. Rarely giant aneurysms (>25mm size) can press on areas of the brain and cause neurological symptoms such as weakness, speech problems, and seizures.

Subarachnoid Haemorrhage (SAH)

When an aneurysm ruptures it allows high pressure arterial blood to spurt into the CSF around the brain. This is called a subarachnoid haemorrhage (SAH). As the pressure in the head suddenly rises, the bleeding stops, and the hole in the aneurysm is sealed by a delicate

clot. The aneurysm is therefore very fragile, and about 12% of people who survive the initial SAH will bleed again in the first 24 hours¹, with this rebleed often being fatal. Therefore, unlike a person with an unruptured aneurysm, a person with a SAH needs urgent management

by a cerebrovascular neurosurgeon for obliteration of the aneurysm by microsurgical clipping or coiling (see page 3).

A person who has a SAH experiences abrupt onset of severe headache, often called “thunderclap” headache. Many patients also lose consciousness,

SAH (continued from page 1)

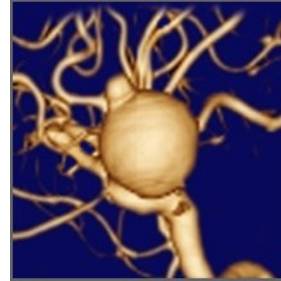
Plain CT scan showing SAH (blood is white: arrow)



and some die before reaching hospital. Neurosurgeons usually grade the SAH according to the patient's conscious state on arrival at hospital. Good grade patients can speak, although they may be confused, whereas poor grade patients are comatose. The chance of good recovery is much poorer for poor grade patients, although we have demonstrated that the outlook is often far from hopeless with urgent expert aggressive

treatment², even in elderly poor grade patients³.

After the aneurysm is obliterated,



Large aneurysm

SAH patients still need expert cerebrovascular care as they are at risk of delayed complications, such as hydrocephalus (blockage of CSF pathways possibly requiring a shunting operation), vasospasm (narrowing of the vessels which can cause stroke or even death), epilepsy seizures, and of course general complications which can affect any ill or post-operative patient (e.g.. chest infections, blood clots etc).

2. Laidlaw, J.D. and K.H. Siu, Poor-grade aneurysmal subarachnoid hemorrhage: outcome after treatment with urgent surgery. *Neurosurgery*, 2003. 53(6): p. 1275-80.
 3. Laidlaw, J.D. and K.H. Siu, Aggressive surgical treatment of elderly patients following subarachnoid haemorrhage: management outcome results. *J Clin Neurosci*, 2002. 9(4): p. 404-410.

“The risk of an unruptured aneurysm bleeding is actually quite low in the short-term (in the order of 1% per year).

Should an aneurysm be treated?

Any aneurysm that has ruptured requires urgent treatment to prevent rebleeding, as does an enlarging aneurysm causing neurological problems.

However, someone who has been found to have an unruptured aneurysm has a much lower risk of bleeding. Exactly what this risk is not definitely known, as there have been conflicting reports.

In general, cerebrovascular neurosurgeons consider the risk of a very small (<3mm) aneurysm bleeding to be extremely small. However, the larger the aneurysm, the higher the risk. A rough guide is to expect an annual rupture risk of around 1% each year for aneurysms 7-12mm, 3% each year for 12-24 mm, and probably >10% each year for >24mm. Other factors such

as smoking, aneurysm site, previous SAH also affect the risk.

People with an unruptured aneurysm therefore need to consider their age, general health, risk of treatment and risk of rupture before deciding what their management plan will be. They need expert advice from an experienced expert cerebrovascular neurosurgeon.

Wiebers et al. International Study of Unruptured Intracranial Aneurysms Investigators. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. *Lancet*. 2003;362:103-110.

Cerebral angiography

Although the blood from a SAH is usually clearly seen on a routine CT scan, the aneurysm itself is rarely identified. However, newer types of scans (CTA/MRA) can often show the aneurysm.

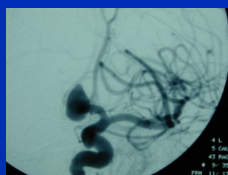
To accurately determine the

aneurysm anatomy, a cerebral angiogram (or digital subtraction angiogram; DSA) is usually required.

For angiography, a fine tube (catheter) is inserted into the artery in the groin, and then floated in the bloodstream into the arteries supplying the brain. Dye (contrast) is then injected through the catheter

into these arteries and a rapid sequence of xrays taken, showing the arrangement of arteries and veins and the blood flow.

Risks of angiography in a skilled neuroradiologist's hands are small (usually <1%), but can include stroke, contrast allergy, and blood vessel injury.



Angiogram being performed (right) and showing aneurysm (above)



Aneurysm Surgery



Diagram of aneurysm clipped, taking care not to block arteries

Microsurgical clipping of an aneurysm involves a craniotomy (lifting a small plate of skull bone, that is replaced at the end of the procedure). Using the microscope the arteries under the brain are exposed while applying minimal pres-

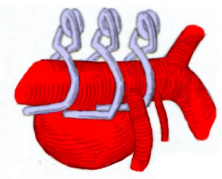
sure on the brain. The aneurysm is then exposed and a small clip, or combination of clips, are used to pinch off the aneurysm, while making sure the arteries are not narrowed or occluded.

This is an extremely technically demanding procedure, and usually only performed by cerebrovascular neurosurgeons experienced in aneurysm surgery.

The risks of the procedure are largely dependent on the size and the site of the aneurysm, the amount of atheroma in the patient's arteries, and the patient's

general health.

In general, an expert cerebrovascular neurosurgeon would expect less than 2% risk of serious complications (death, stroke, major neurological deficit) for a routine clipping of an unruptured aneurysm. However, the risk is somewhat higher for surgery on a ruptured aneurysm. Other risks include heart and lung problems, blood clots, seizures, infections etc, but for an elective case these would usually be small.



Complex aneurysm clipped with multiple fenestrated clips

“ The decision whether to clip or coil an aneurysm should be made by a cerebrovascular neurosurgeon in consultation with an interventional neuro-radiologist”

Endovascular aneurysm treatment

Endovascular treatment is usually performed by an interventional neuro-radiologist (INR) who is very experienced in the technique and performs many cases a year. It is often called “coiling”, as the most common treatment packs the aneurysm with platinum coils, although sometimes vascular stents (sleeves inside the artery) and other endovascular techniques are also used.

Coiling involves a cerebral angiogram, usually under general anaes-

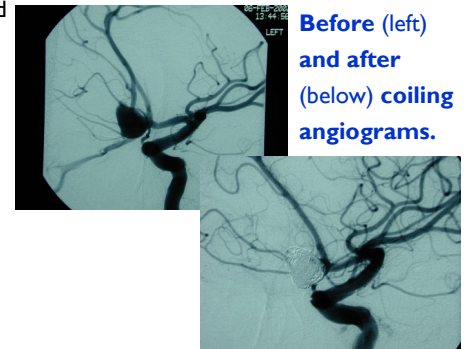
thetic, and the catheter is passed up into the arteries in the head and eventually into the aneurysm itself. A platinum coil is then passed through the catheter into the aneurysm, and further coils are added until the aneurysm is fully packed with coils.

If the aneurysm can be fully packed then the coiling procedure is very effective in preventing future bleeds.

The risks of coiling include stroke,

and aneurysm rupture, and risks of angiography and anaesthetic.

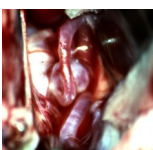
Therefore, although this doesn't require a craniotomy (open brain surgery), it must be considered to be a serious procedure. The risk depends largely on the size and shape of the aneurysm, blood vessel disease, and the experience of the neuro-radiologist.



Before (left) and after (below) coiling angiograms.

Clipping or coiling?

The decision whether an aneurysm is best treated by clipping or coiling should be made by an experienced cerebrovascular neurosurgeon and experienced INR, after discussing the case in detail, in every case. Together they need to discuss the angiogram to determine which method will be most



Aneurysm at surgery

effective and least risk for that particular patient. Although most cerebrovascular neurosurgeons and INR have similar opinions regarding the best treatment, it is important to involve more than one expert in the decision, even in emergency cases.

It is important that the patient fully understands the reasons for the advice regarding which method is advised, and that he/she fully understands the relative risks and

benefits of each method for his/her aneurysm.

If a SAH patient also has a significant clot in the brain from the aneurysm rupture, then this should generally be removed surgically and the aneurysm clipped at the same time (not coiled).



Diagram of coiled aneurysm, and a single coil.



John Laidlaw Neurosurgery

John Laidlaw FRACS (Neurosurgery)

Director of Cerebrovascular Neurosurgery | Royal Melbourne Hospital
Associate Professor | Dept of Surgery, University of Melbourne

**Suite 13, Private Medical Centre,
The Royal Melbourne Hospital,
Parkville. 3050. Australia**

Tel: +61 3 93471533

Fax: +613 93472633

www.johnlaidlaw.com.au

Associate Professor John Laidlaw is an experienced neurosurgeon trained in Australia and USA. His areas of particular interest and expertise include cerebrovascular surgery, skull-base surgery, brain tumour surgery, and surgery on the cervical spine and craniocervical junction.

Surgery, if appropriate, is usually performed using the most minimally invasive microsurgical techniques appropriate to the case. All surgical procedures are performed at The Royal Melbourne and Melbourne Private Hospitals.

All consultations (insured or uninsured patients, Parkville or Geelong rooms, or Royal Melbourne Hospital public clinics) should be arranged through the Parkville rooms.

Risk factors for SAH & aneurysms

Aneurysms are not strictly inherited, although there are some families with a particularly high incidence of aneurysms and recently some genes have been associated with a higher risk of developing aneurysms. Adult family members of people with known aneurysms are therefore commonly offered screening procedures. If 2 or more immediate family members have intracranial aneurysms then screening of other adult family members is usually advised. We don't usually recommend screening children, as aneurysms usually develop after childhood.

Some other rare genetic inherited conditions, such as Ehlers-Danlos syndrome and polycystic kidney disease are associated with an increased risk of aneurysm formation, as are certain vascular conditions such as fibromuscular dysplasia.

However, the majority of people with aneurysms are sporadic cases, with no family members affected and no identifiable associated conditions.

Hypertension (untreated high blood pressure) is thought to be a predisposing factor for aneurysm formation and rupture, although there is some debate about this. Nevertheless, good blood pressure control is known to dramatically reduce the risk of stroke and blood vessel disease, and we would strongly advise all adults to have regular blood

pressure checks, and if high have it treated and maintained in the normal range.

Tobacco smoking has been found to increase the risk of aneurysm rupture, as well as increasing risks of stroke and many other diseases. We strongly advise all patients not to smoke, but this is critical in anyone with a high stroke risk or who has an aneurysm.

Many rumours abound about stress, sexual activity, sports, heavy lifting etc causing aneurysms to rupture.

There is no good evidence to support these claims, and people with unruptured aneurysms are encouraged to lead relatively normal healthy lifestyles.

