Subarachnoid Hemorrhage and Brain Aneurysm
Subarachnoid Haemorrhage is the sudden leaking (haemorrhage) of blood from the blood vessels of brain. The brain is covered by layers of membranes, one of which is called the arachnoid membrane. A Subarachnoid haemorrhage occurs under this layer. (Fig.1)

The commonest symptom of SAH is severe headache. After minutes to hours the headache spreads to the back of the head, neck and back as blood tracks down the spinal subarachnoid space.
In most cases subarachnoid haemorrhage is due to a weakness in the wall of one of the arteries of the brain, leading to aneurysm formation.

An aneurysm is a balloon-like projection from the artery.

This aneurysm is generally present in the patients right from the beginning of life and keeps growing in size slowly due to high arterial blood pressure. At some stage, the wall of the balloon (aneurysm) is stretched so much that it ruptures leading to haemorrhage.

In rare cases, subarachnoid haemorrhage can occur because of rupture of an abnormal tangle of blood vessels called an anteriovenous malformation (AVM) or very rarely due to a situation called dural AVF.
Sudden severe headache, often at the back of the head followed by nausea & vomiting. May be associated with:

- Loss of consciousness.
- Fits or
- Paralyses
How diagnoses of SAH is confirmed?

- **Clinical:**
  - Typical history of severe headache or unconsciousness.
  - Family History.
  - Stiff neck on examination.
  - High Blood Pressure.

- CT Scan (to demonstrate haemorrhage): Most important test.

- L.P. (Lumbar Puncture) in some cases.
The incidence of SAH increases with age. It is higher among women than men.

In SAH, rupture of an intracranial aneurysm is most frequently into the subarachnoid space and less commonly into the intraventricular and intracerebral spaces.

Bleeding may result in brain damage, decreased blood flow to brain, brain shift and herniation, and hydrocephalus.

Patients who survive the initial insult are at risk of secondary complications for the next three weeks, notably aneurysmal rebleeding and cerebral vasospasm.

The rate of rebleeding is highest (4%) during the first 24 hours after the initial haemorrhage and declines to 1%-2% per day thereafter for the next 4 weeks.

A vertebral Artery Angiogram showing a Basilar top aneurysm
Unruptured aneurysms (Incidentally Diagnosed on Investigation)

**Genetic factors:** The risk of SAH is fourfold higher in first-degree relatives of SAH patients than in the general population. Epidemiological studies indicate that 7%-20% of patients with SAH have first- or second-degree relatives with unruptured aneurysms.

**Smoking.** Cigarette smoking is the only factor that has been consistently and strongly associated with increased risk of SAH. Cigarette smoking increases risk of symptomatic vasospasm after SAH. People who quit smoking appear to have reduced SAH risk relative to current smokers, with the time since smoking cessation being inversely related to SAH risk.

**Hypertension.** Although hypertension is a recognized risk factor for hemorrhagic stroke, little information is available on whether elevated blood pressure increases risk of aneurysmal SAH.

**Increased age.** Most clinical series of SAH show a peak incidence in the fifth and sixth decades of life.

**Female gender.** Epidemiologic studies show that SAH is the only type of hemorrhagic stroke that is more common in women than in men, but prospective studies do not support this finding.

**Other factors.** Several other factors, including alcohol or binge drinking and drug abuse, have been associated with increased risk of SAH in case reports or cohort studies.
Non-traumatic aneurysmal subarachnoid hemorrhage afflicts an estimated 28,000 people in the U.S. each year. Population-based studies suggest that SAH represents 5%-10% of all strokes.

Approximately 25% of patients die from the immediate hemorrhage or as a consequence of secondary complications, and 50% of those patients who survive become seriously disabled.

SAH is associated with a high degree of mortality and morbidity, part of which is caused by neurological deficits that are secondary to the initial hemorrhagic event.

The estimated lifetime cost for annual cases of patients hospitalised with aneurysmal SAH in the U.S. is $1.75 billion.
How severity of SAH is graded:

The severity of SAH is graded commonly by a clinical grading system known as Hunt & Hess grading system.

**Hunt And Hess Scale For Grading SAH**

<table>
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<tr>
<th>Grade</th>
<th>Neurological Status</th>
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<tr>
<td>I.</td>
<td>Asymptomatic; or minimal headache and slight nuchal rigidity</td>
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<tr>
<td>II.</td>
<td>Moderate to severe headache; nuchal rigidity; no neurologic deficit except cranial nerve palsy</td>
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<tr>
<td>III.</td>
<td>Drowsy, minimal neurologic deficit</td>
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<tr>
<td>IV.</td>
<td>Stuporous; moderate to severe hemiparesis; possibly early decerebrate rigidity and vegetative disturbances</td>
</tr>
<tr>
<td>V.</td>
<td>Deep coma; decerebrate rigidity; moribund appearance</td>
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Find out the cause of SAH: The commonest cause of SAH is Brain Aneurysm.

**Brain Aneurysm:** The ballooning of brain artery usually at the point where it divides into two.

**Detection of Brain Aneurysm:**

- **Cerebral Angiography (DSA):** It is considered as a Gold Standard in the diagnosis of aneurysm. This test gives the physician comprehensive information about the size, number and characteristics of the aneurysms which helps him decide the treatment modality as well as the urgency of intervention.

- **CTA**
- **MRA**

What to do next?
Treatment of SAH

- I.C.U. monitoring
- Medical treatment to prevent cerebral vasospasm
- Control of BP
- Intervention to prevent re-bleed (treatment of aneurysm)
Main objectives of treatment of an aneurysmal SAH are:

- to protect patient from **rebleeding** of the ruptured aneurysm. and

- prevent delayed ischemic deficit associated with cerebral **vasospasm** i.e. the narrowing of the large capacitance arteries at the base of the brain that leads to reduced perfusion of distal brain regions.
Methods to treat Brain Aneurysm

Endovascular Coiling

Surgical Clipping
Endovascular Coiling

The purpose of the operation or coiling is to prevent further haemorrhages. Increasingly, more patients are receiving less-invasive “endovascular” treatment called coiling. Most of the aneurysms can be treated via angiography, with the insertion of platinum coils to fill the aneurysm.
In this a catheter is passed through one of the arteries of the leg and then through the brain artery a micro-catheter is positioned into the aneurysm sac and then aneurysm is coiled with detachable GDC-coils. Sometimes if the neck of the aneurysm is wide then it can still be coiled endovascularly with the support of a stent.
A 45 yrs male presented with sudden onset severe headache with vomiting. On doing a CT scan of brain he was diagnosed as a case of SAH. Cerebral DSA revealed a Basilar Top aneurysm (fig), which was coiled and patient was discharged from the hospital without any problems in his and he is now living a normal life.
Clipping (Surgical): In surgical clipping, to get to the aneurysm, the surgeon must first remove a section of the skull, a procedure called a craniotomy. The aneurysm is carefully separated from the surrounding brain tissue, and a small metal clip is placed across the neck (base) of the aneurysm, bone is secured in its original place and the wound is closed.
The International Subarachnoid Aneurysm Trial, or ISAT is the only multi centre prospective randomized trial that compares surgical clipping with endovascular coiling for the treatment of ruptured intracranial aneurysms. This means that patients with aneurysms that could be treated by either surgery or coiling were enrolled and randomly assigned to receive one of these two treatments. They were then followed to see how they recovered. Published in the British Medical Journal, The Lancet, the study concluded that "in patients with a ruptured intracranial aneurysm, for which endovascular coiling and neurosurgical clipping are therapeutic options, the outcomes in terms of survival free of disability at 1 year is significantly better with endovascular coiling."
Vasospasm (seen in about 25% cases): The other main complication is delayed spasm of the blood vessels, which may occur a week or more after the SAH and can cause permanent or fatal strokes.

Hydrocephalus: Occasionally epileptic fits may occur, but these can be controlled with medication. Sometimes there is a build-up of the fluid in and around the brain and spinal cord (hydrocephalus); this causes generalised headache and problems with higher mental functions and memory and with balance. A small operation to insert a tube (shunt) can be performed to drain the excess fluid.
Patients in the immediate aftermath of a subarachnoid hemorrhage **should not:**

- Smoke
- Drive until given permission to do so by their doctor
- Climb ladders, swim unaccompanied, or do other activities which may be dangerous in event of a fit.

Patients should gradually be able to resume their normal lives as they feel able to do so. Any doubts (such as when to return to work, or the advisability of resuming sporting activities) should be discussed with the treating doctor. It is essential to maintain a regimen of regular exercise, and continue medication as advised by the doctor, especially if treatment for high blood pressure is needed.


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