Description

Cerebral vasospasm is the physical narrowing of a blood vessel in the brain due to over-contraction of the vessel wall.

By definition, ‘cerebral’ refers to the brain, ‘vaso’ refers to blood vessels, and ‘spasm’ refers to the constricted, ‘spastic’, or shut-down state of the vessel. There are varying degrees of cerebral vasospasm, the worst case scenario being a blood vessel which is completely constricted, thus completely blocking blood flow to the area of the brain which is supplied by that particular blood vessel. This can cause damage to the brain tissue in that area and result in serious consequences.

Cerebral vasospasm generally occurs as a complication of a ruptured brain aneurysm resulting in a subarachnoid haemorrhage, but may also occur rarely as a complication of haemorrhage from another blood vessel abnormality or trauma. These situations have in common the abnormal presence of a large amount of blood on the outside of the brain (the ‘subarachnoid space’).

Following subarachnoid haemorrhage from a ruptured brain aneurysm, vasospasm can occur in up to 70% of cases. The highest period of risk is 7-10 days following the bleed, but can occur at any time from 3-15 days after the ruptured aneurysm. It will generally resolve spontaneously after 21 days.

Cerebral vasospasm generally tends to occur only in the larger arteries in the brain, and not in smaller arterioles, veins or capillaries. This is due to the thicker smooth muscle layer in larger arteries which can contract tightly, as opposed to the thinner-walled smaller vessels which are less likely to constrict tightly.

Diagnosis

For any patient at risk of vasospasm, i.e. those with subarachnoid haemorrhage from any cause, frequent examinations will be undertaken by medical and nursing staff to recognise changes in the neurological state of a patient. Symptoms and signs of vasospasm may be similar to those exhibited when a person is having a stroke. These include a decrease in level of consciousness, confusion, facial asymmetry or loss of power or sensation in the limbs. If this occurs, further investigations will be done urgently.

CT scanning is commonly used for patients with subarachnoid haemorrhage who show signs of neurological deterioration. It is possible to obtain high-quality images of the brain’s blood vessels by injecting a contrast dye into the vein of the patient and then taking images to visualise the flow of contrast.
through the arteries in the brain. This technique is known as computed tomography angiography (CTA). A similar technique can also be used with an MRI machine (MRA).

A more invasive method of diagnosis of cerebral vasospasm is known as digital subtraction angiography (DSA). This is a procedure which uses contrast dye just as in CTA and MRA, however DSA is performed in an operating theatre and involves insertion of a thin plastic catheter into a blood vessel in the groin. The catheter travels up to the neck and head arteries, and the dye is injected into the arteries as x-rays are taken.

DSA is considered the ‘gold standard’ of diagnosis of cerebral vasospasm, however is more invasive and poses a higher risk of complications than CTA or MRA. An advantage of DSA is that it is possible to treat cerebral vasospasm by injecting a medication into the wall of the vasospastic artery at the time of angiography.

Treatment

Maintaining physical parameters within normal range is important in reducing the risk of vasospasm and limiting any long-term neurological damage should vasospasm occur. These parameters include blood pressure, temperature, blood sugar level, and electrolyte and oxygen levels. Patients with subarachnoid haemorrhage are usually managed within an intensive care unit so that close monitoring of these parameters can take place.

All patients who have a subarachnoid haemorrhage from any cause are at risk of vasospasm. In patients who have a ruptured aneurysm, certain factors increase the likelihood of vasospasm occurring. Subarachnoid haemorrhages are given a grade of severity based on the amount and location of the blood (determined by CT or MRI imaging). The higher the SAH grade, the higher the risk of vasospasm. Other risk factors include prolonged coma after aneurysm rupture, age less than 50 years, smoking, high blood pressure prior to the aneurysm rupture, high blood sugar, cocaine use, and genetics. There is no difference in the risk of vasospasm between patients who have had their aneurysm clipped or coiled (two different surgical methods of treating aneurysms).

Patients who have subarachnoid haemorrhage secondary to a ruptured aneurysm will be started on a medication called Nimodipine. This drug belongs to a group of medications known as calcium channel antagonists which help to relax blood vessels. Nimodipine works more specifically than other drugs in the same class on blood vessels which are in the brain. Nimodipine will usually be started as soon as possible after an aneurysm rupture to prevent cerebral vasospasm, and can be given as tablets to swallow or as an injection into the vein.

If the vasospasm is severe enough to cause symptoms, DSA will be undertaken as soon as possible (discussed above under Diagnosis). During this procedure, constricted blood vessels can be identified and treated in one
of two ways. The first method is to inflate a small balloon in the constricted artery, increasing its diameter and thus blood flow through the artery. Alternatively it is possible to inject a medication into the vessel to relax the constricted walls. Treatment may or may not be successful, and will not always prevent permanent damage. There remains a risk of further cerebral vasospasm even after an episode has been managed using DSA and intra-arterial injection or balloon dilation.

**Prognosis**

Cerebral vasospasm causes a lack of blood and nutrient supply to the part of the brain which is usually supplied by that artery. This part of the brain is then starved of blood and nutrients (such as oxygen) and may be damaged or die (a type of “stroke”).

The clinical effects of cerebral vasospasm occur in one-third of all patients who suffer a subarachnoid haemorrhage from a brain aneurysm rupture. These patients can suffer permanent brain damage or death from this complication. Overall, cerebral vasospasm accounts for approximately 20% of the severe disability and death associated with ruptured aneurysms.