

Subarachnoid hemorrhage

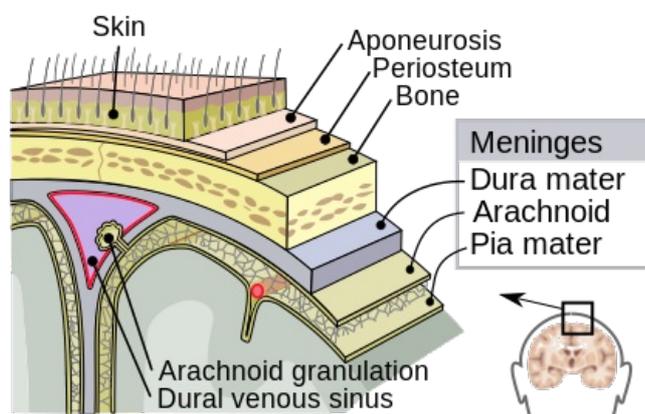
During a **subarachnoid hemorrhage** (SAH), blood leaks into the cerebrospinal fluid pathways between the arachnoid and the pia mater. It is massive bleeding from the arterial system.

Causes

It most often occurs during aneurysm rupture (60%) in the area of the circle of Willis, especially on the anterior or posterior communicating artery, often during the blood pressure increase (physical exertion, coitus, irritation, defecation, etc.). Other causes could be trauma, vascular malformations such as arteriovenous and cavernous malformations, anticoagulant therapy, bleeding diseases, hypertension, amyloid angiopathy or primary vasculopathy. There are also idiopathic (cryptogenic) SAHs. Traumatic SAHs are often associated with a contusion.

Symptoms

The headache comes within seconds and can be very intense. It is located bilaterally, sometimes with a maximum in the occipital area. Initially, there may be a short unconsciousness. The pain is also accompanied by nausea, vomiting, photophobia and phonophobia. This condition can develop within minutes or hours into a meningeal syndrome. Patients are often disoriented and confused. Some patients are somnolent up to the point of sopor, and sometimes, on the other hand, psychomotor restlessness, aggressiveness or negativism can dominate. There are usually focal symptoms during an intracerebral SAH. We assess the patient's condition using the Hunt and Hess scale. **⚠️ In some cases, the symptoms may be less intense and they could mimic cervicocranial syndrome. Therefore we always indicate brain CT and LP in unclear cases.**



Meninges

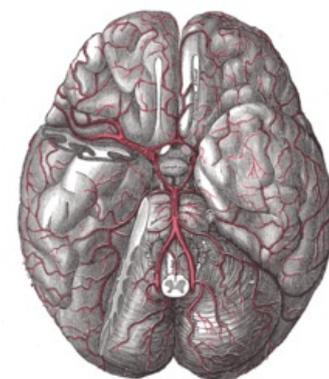
Diagnostics

We establish the diagnosis with a CT scan. About 5% of CT examinations do not show SAH in the first 24 hours, so if the SAH is suspected, we indicate a cerebrospinal fluid examination. A typical cerebrospinal fluid finding is oxyhemoglobin during a spectrophotometric examination. **⚠️ Liquor must be processed within 1 hour after collection. We also find increased proteins and during the cytological examination thousands to hundreds of thousands of erythrocytes, from the 3rd to the 4th day erythrocyte phagocytosis and maximum bilirubin during spectrophotometry.**

Treatment

If SAH is proven, we send the patient to neurosurgery for cerebral panangiography, which should be performed within 72 hours from the beginning of the symptoms due to the risk of vasospasm. When an aneurysm is found and the score according to the H+H scale is up to 3, surgery is indicated - either clipping the aneurysm neck or filling the aneurysm cavity with a detachable spiral - coiling. Bed rest (**always with hospitalization**) is essential as well as symptomatic treatment (analgesics, antiemetics, correction of hypertension). Vasospasms can be softened by calcium ion blockers.

If the aneurysm is not detected, the patient is treated conservatively - painkillers, mucolytics and laxatives. After 3-6 weeks a control panangiography is indicated.



Circle of Willis

Aneurysm bleeding

An aneurysm is a circumscribed enlargement of a cerebral artery. The bulge is caused by the long-term effect of blood pressure on a weakened vessel wall (congenital defects, atherosclerosis, fungal infections, trauma, etc.). Arching thins the vessel wall, which bursts with a sudden increase in blood pressure (exertion, defecation, coitus, upset, bending forward). Aneurysms are most often found in the area of the circle of Willis, especially on the internal carotid artery, a. communicans ant., a. cerebri media.

Bleeding from a cerebral aneurysm is relatively common in the Czech Republic (about 600 cases of SAH per year), unfortunately with a very high mortality rate (40% of patients die after the first bleeding). Aneurysms themselves (especially smaller ones) are clinically silent until they rupture and bleed.

Symptoms

Manifestations are sudden, dramatic and rapidly progressive. The initial symptom is an intense **headache (severe, not yet recognized)**, followed by nausea, vomiting, an increase of systemic pressure due to Cushing's reflex, photophobia and impaired consciousness. There could also be present symptoms such as focal neurological findings depending on the location of the aneurysm, epileptic seizures, meningism, high temperature, lesions of the third and sixth cranial nerves etc.

Diagnosis

To establish the diagnosis of SAH, it is necessary to perform a CT scan (evidence of blood in the cerebrospinal fluid spaces, intracerebral hematoma), which can even approximately outline the source of the bleeding. That will subsequently be refined with cerebral panangiography, which we try to perform as soon as possible after the diagnosis of SAH, and always in at least two projections. For patients without intracranial hypertension, in whom the CT scan was not sufficiently conclusive, we collect and examine CSF (proof of the presence of erythrocytes or xanthochromin).

The therapeutic procedure is based on the **Hunt and Hess scale**.

- **grade 0** - non-bleeding aneurysm, without symptoms,
- **grade I** - headache, neck opposition, mild meningeal syndrome,
- **grade II** - headache, neck opposition, cranial nerves lesions, more severe meningeal syndrome,
- **grade III** - attenuation or confusion, slight focal finding,
- **grade IV** - stupor, decerebrate rigidity, vegetative disorders,
- **grade V** - deep coma, decerebrate rigidity

Arteriovenous malformations

An AV malformation (AVM) is a congenital convolution of arteries and veins that directly communicate with each other and between which a capillary system has not been formed. As a result of the defect, capillary resistance is negligible, which results in increased blood flow in the malformed vessels. At the expense of this, other areas have less blood supply and are prone to ischemia (*steal phenomenon*).

Clinically, AVM is manifested by bleeding (70%), not only with SAH but also with intracerebral hemorrhage. Ischemia of less blood-supplied parts leads to localized manifestations (e.g. epileptic seizures).

For basic diagnosis, we use CT and MRI, then we clarify the source of the bleeding using PAG.

Therapy

Malformations tend to be extensive and often difficult to access surgically. If these are not very acute cases, we choose the *"watch and scan"* method, during which we evaluate the condition of individual vessels and their progression over time. Subsequently, we perform the procedure on arteries that could be at risk.

The operation consists of closing the supply arteries by bipolar coagulation (the performance takes many hours and is difficult). An alternative is the embolization of arteries endovascularly or the Leksell gamma knife.

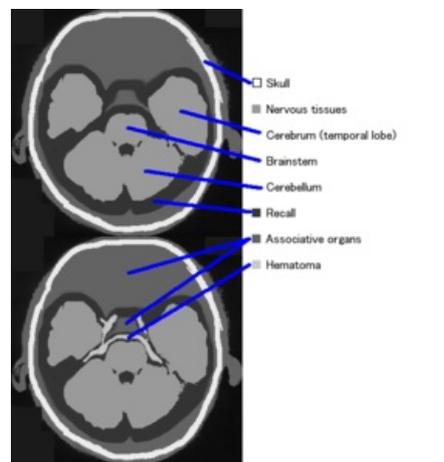
Cavernous hemangioma

This is a special type of AVM. A cavernoma is a circumscribed, small vascular formation in brain tissue that does not have wide supplying arteries. For that reason, it is not usually visible on the PAG, so we prefer MRI for diagnosis.

Bleeding is not extensive, but rather frequent.

Differential diagnosis

- Subdural hemorrhage
- Epidural bleeding
- Migraine
- Acute cervicocranial syndrome
- Meningitis



Subarachnoid hemorrhage scheme - CT scan



SAH - CT scan

Links

Related articles

- Treatment of intracranial aneurysm
- Craniocerebral trauma
- Brain vessels
- Stroke
- Circle of Willis
- Aneurysm
- Arteriovenous malformation
- Cavernous malformation

References

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