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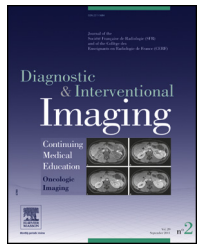

CONTINUING EDUCATION PROGRAM: FOCUS...

Subarachnoid hemorrhage in ten questions

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Abstract Traumatic subarachnoid hemorrhage (SAH) has an annual incidence of 9 per 100 000 people. It is a rare but serious event, with an estimated mortality rate of 40% within the first 48 hours. In 85% of cases, it is due to rupture of an intracranial aneurysm. In the early phase, during the first 24 hours, cerebral CT, combined with intracranial CT angiography is recommended to make a positive diagnosis of SAH, to identify the cause and to investigate for an intracranial aneurysm. Cerebral MRI may be proposed if the patient's clinical condition allows it. FLAIR imaging is more sensitive than CT to demonstrate a subarachnoid hemorrhage and offers greater degrees of sensitivity for the diagnosis of restricted subarachnoid hemorrhage in cortical sulcus. A lumbar puncture should be performed if these investigations are normal while clinical suspicion is high.

Subarachnoid hemorrhage (SAH) is defined as blood in the cerebrospinal fluid contained in the basal cisternae and the sub-arachnoid space of the cerebral hemispheres, contained between the arachnoid mater and the pia mater.

The most common cause is head injury. Apart from this cause, SAH accounts for 5 to 10% of cerebrovascular accidents and has a high mortality rate, which is estimated to be

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between 40 and 50% [1,2]. By far the most common cause of SAH apart from trauma is intracranial aneurysm rupture (85% of non-traumatic causes) [3].

If SAH is suspected, cerebral imaging should be performed urgently to confirm the diagnosis, identify any complications and investigate its cause.

We propose you here to develop the theme of SAH through ten questions. We will not consider the complications of rebleeding and vasospasm in this article.

When a patient presents with a sudden-onset headache, is CT an appropriate investigation?

Unenhanced cerebral CT is recommended for acute headaches (less than 24 hours old), which are sudden in onset, to investigate for a subarachnoid hemorrhage (SAH) (grade A guideline, guide to the correct use of medical imaging examinations).

The clinical features of the headache are fundamental. A SAH should be suspected in the case of a sudden-onset headache of maximum intensity from the outset and described as a ''thunderclap in a clear sky''. This may be combined with meningism without fever or reduced consciousness level. An urgent CT should be performed and enables a diagnosis of SAH to be made if an unenhanced hyperdensity is present in the subarachnoid spaces, which usually involves the basal cisternae, inter-hemispheric sulci and lateral sulci [4]. When it is performed during the first 24 hours, CT has a sensitivity of 95% [5]. The sensitivity of CT depends mostly on the extent of the SAH but also on hemoglobin concentration and falls with the time between the initial headache and time when the scan is performed. After 7 days, therefore, CT is positive in only 50% of cases in SAH.

Apart from a positive diagnosis of SAH, the initial CT examination can detect the early complications of hydrocephalus, intraparenchymal hematoma with space occupying effect and ventricular hemorrhage (Fig. 1).

Hydrocephalus which begins with dilatation of the temporal horns, and a compressive intra-parenchymal hematoma are important to report as these are life-threatening and require immediate neurosurgery with an external ventricular shunt, or evacuation of the hematoma before treatment for the cause of the SAH [6].

Using the modified Fisher scale [7] (Fig. 2, Table 1), CT is also of prognostic value in terms of the secondary development of vasospasm as the scale is a predictive indicator for vasospasm.

Whilst sudden-onset headache is an indication for CT, an unenhanced investigation is not sufficient. Sudden-onset headaches may be due to an aneurysm which has not ruptured. In this case, the term sentinel headaches is used, which describes a state of pre-rupture or fissuring of the aneurysm. It is therefore recommended that for sudden-onset headaches, even without SAH, imaging of the circle of Willis be performed to look for an intracranial aneurysm.

Are there signs which help to localize the source of the bleeding?

Neurological signs

A IIIrd cranial nerve palsy on a background of sudden-onset headache is a clinical localizing sign and indicates pressure on the nerve, either directly by the aneurysm or by the hematomas secondary to rupture of the aneurysm. The aneurysm itself can then be looked for the posterior wall of the ending of the internal carotid artery, close to the origin of the posterior communicating artery (Fig. 3), or less commonly, developing at the origin of the superior cerebellar artery.

On the other hand, features of pyramidal irritation and paralysis of the VIth cranial nerve are of no localizing value.

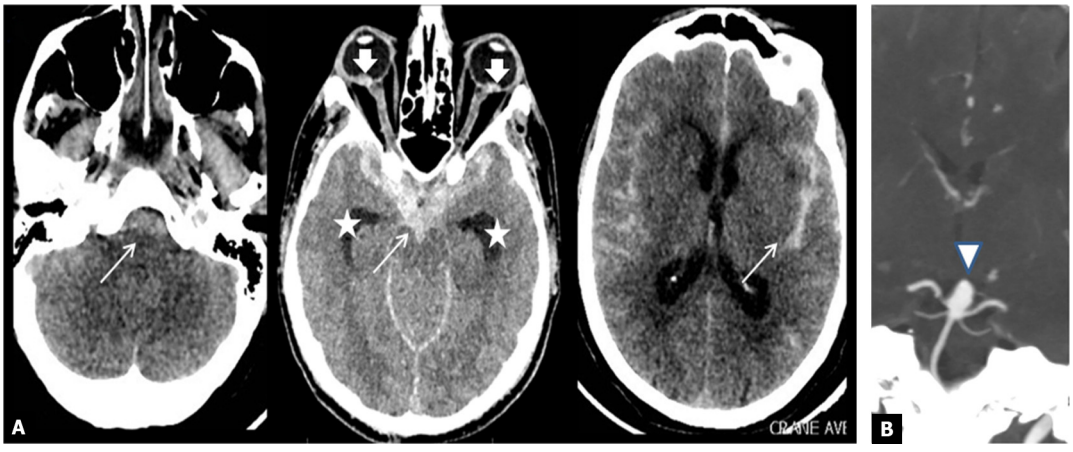

Figure 1. Axial cerebral CT without enhancement (A) and angiogram of the arterial circle at the base of the brain (B) on MIP reconstructions centered on the circle of Willis. Positive diagnosis of subarachnoid hemorrhage (A): unenhanced hyperdensity in the subarachnoid spaces (arrow) affecting the basal cisternae, motor cortex sulchi and interhemispheric fissure without flooding of the ventricles. Diagnosis of an early complication: early hydrocephalus with dilation of the temporal horns (star). Coexistent preretinal hemmorage (Terson Syndrome, thick arrow). Diagnosis of cause (B): ruptured terminal basilar artery aneurysm (arrow head).