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Letter to the Editor

Role of neuroimaging in initial assessment of subarachnoid hemorrhage

Dear Editor,

Radiological evaluation is fundamental to the management of patients with subarachnoid hemorrhage (SAH). The importance of diagnostic imaging lies in the detection of lesion progression and complications, allowing initiation of timely therapy. Poor-grade SAH patients (Hunt and Hess grade 4 and 5) constitute 18–24% of SAH patients and have worse long-term functional outcomes and higher mortality rates [1].

There are two types of SAH: traumatic and spontaneous. Spontaneous causes of SAH include: cerebral aneurysm (the most frequent), perimesencephalic vascular malformation (arteriovenous malformation (AVM)) arterial dissection, cerebral amyloid angiopathy, moyamoya, vasculitis (e.g., lupus), coagulopathy (thrombocytopenia, anticoagulation therapy) sickle-cell disease, hypertension, and sympathomimetic drugs [2].

Thunderclap headache (TCH) is an excruciating headache that culminates within a minute of onset. TCH used to be considered synonymous with SAH, but that changed with the discovery of differential diagnoses presenting with TCH other than SAH, such as reversible cerebral vasoconstriction syndrome (RCVS), cervical artery dissection, cerebral venous sinus thrombosis (CVT), cerebral infarction, intracerebral hemorrhage, spontaneous intracranial hypotension (SIH), intracranial infection, pituitary apoplexy, colloid cyst of the third ventricle, ischemic stroke, and acute hypertensive episode [3].

The Ottawa SAH Rule is a validated tool with sensitivity that approaches 100% in the first 6 hours of onset of headache; it helps small health centers to decide which patients with acute headache will benefit from transfer to large hospitals for non-contrast CT imaging; in clinically suspected cases where CT is negative, lumbar puncture (LP) is performed to screen for xanthochromia [3]. Xanthochromia is pathognomic for SAH but takes up to 12 hours to develop, with risk of false-positives due to ex-vivo hemolysis, or hyperbilirubinemia [2]. Furthermore, the debate on visual assessment versus spectrophotometry to reveal xanthochromic CSF has yet to show significant results [2].

CT angiography (CTA) is an alternative examination in clinically suspected CT-negative cases or where the patient does not consent to LP, and can detect aneurysms with diameter greater than 3 mm with 98% sensitivity and 100% specificity [3].

Regarding magnetic resonance imaging (MRI) and MR angiography (MRA), the extensive availability of CT units in case of suspicion of aneurysmal rupture has limited research on acute-phase MRI assessment. In the acute phase of SAH, CT is superior to conventional MRI because the blood has a low hematocrit and low deoxyhemoglobin level, so that an aspect of bleeding could resemble that of the brain parenchyma in T1- and T2-weighted spin echo images, while fluid-attenuated inversion recovery (FLAIR) sequences can detect slight bleeding overlooked on CT and conventional MRI [4]. MRA is a suitable alternative when the patient has an iodine contrast dye allergy or when radiation should be avoided [2]. MRA may show false-negative and false-positive aneurysms at the skull base and middle cerebral artery [5]. In poor-grade SAH, diffusion weighted imaging (DWI) reveals acutely ischemic areas that might not be seen on CT [1]. Vasospasm is a prevalent incident, occurring 4–17 days after onset of bleeding [6]. The calcium channel blocker (CCB) nimodipine is administered to prevent vasospasm in aneurysmal SAH [3].

Digital subtraction angiography (DSA) is the standard method to confirm diagnosis of vasospasm. The major advantage of DSA is its accuracy and the ability it provides to perform endovascular treatment immediately. However, the procedure is invasive and is not always available in critically ill patients [6].

Transcranial Doppler (TCD) is a useful tool in the neurocritical care unit (NCCU) to detect and avoid the deleterious consequences of vasospasm occurring after SAH, but is dependent on operator experience. The sensitivity of TCD is 68–94% and specificity 89-100%. TCD is thus a useful test to detect post-SAH vasospasm, and in case of positive TCD there is no need to confirm vasospasm by angiography [6].

Delayed cerebral ischemia (DCI) is a serious cause of mortality in aneurysmal SAH patients and there are many grading criteria correlated to prognosis after SAH: Hunt and Hess scale, GCS score, and the grading scale of the World Federation of Neurosurgical Societies (WFNS). The Fisher CT grading scale is widely used for DCI prognosis, but is criticized for equivalence it makes between intracerebral blood clots and intraventricular hemorrhage, with both counting as grade four (poor grade). An alternative scale was therefore proposed by Claassen et al. but proved no better than the Fisher scale and provided no extra information for prediction of DCI on CT [7].

Despite what was thought by clinicians, early vigorous resuscitation plays a vital role in improving long-term functional outcome in poor-grade SAH patients (Hunt and Hess or WFNS grade 4 and 5), and more studies are needed to enhance early detection of poor-grade SAH, as prognosis depends on the care protocol implemented from admission to rehabilitation [1].

Disclosure of interests

The authors declare that they have no competing interests.

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