Spontaneous Subarachnoid Hemorrhage with Negative Angiography Managed in a Stroke Unit: Clinical and Prognostic Characteristics

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Background: Perimesencephalic subarachnoid hemorrhage (p-SAH) is linked to a benign prognosis compared with aneurysmal SAH. However, the outcome in non-perimesencephalic angiographically negative SAH (np-SAH) is not well established. We reviewed our experience and evaluated the clinical and prognostic differences between patients with p-SAH and np-SAH. *Methods:* Retrospective observational study based on data collected prospectively from all patients admitted to our hospital with SAH during the past 11 years. After selecting patients with normal angiography, we categorized them as either p-SAH or np-SAH according to the Rinkel criteria. Demographic, clinical, radiologic, and prognostic features were recorded. *Results:* We collected a total of 41 (12.53%) angiographically negative SAH: 17 p-SAH (41.46%) and 24 np-SAH (58%-53%). The np-SAH group included the 6 patients with Glasgow Coma Scale (GCS) less than 15 ($P = .083$), and all 5 patients with Hunt & Hess (H&H) scores more than II ($P = .045$), being the GCS = 15 and H&H less than II in the rest of np-SAH and in all of the p-SAH patients. The average hospital stay in days was longer in the np-SAH group (24 ± 7.08) than in the p-SAH group (17 ± 5.11; $P = .55$). Hydrocephalus requiring external ventricular drainage (EVD) was only recorded in the np-SAH group (29.16%, $P = .029$). On discharge, all patients had H&H grade less than II and modified Rankin Scale measured 3 months later was less than 2 in both groups. *Conclusions:* Our results agree with other studies showing a low complication rate for SAH patients with a normal angiography, especially in the p-SAH group. The prognosis appears to be less favorable in terms of a more frequent need for EVD, so a more cautious approach is recommended in this subgroup. **Key Words:** Nonaneurysmal subarachnoid hemorrhage—perimesencephalic hemorrhage—angiographically negative subarachnoid hemorrhage—CT scan—angiography—neuroradiology.

Introduction

Spontaneous subarachnoid hemorrhage (SAH) is an event usually caused by the presence of an underlying vascular disease and most frequently caused by the rupture of a saccular aneurysm, although other causes have been described (arterial dissection, tumors, and so forth).

In about 15% of all patients, angiographic studies show no vascular pathology that would cause bleeding. Such cases are referred to as idiopathic SAH, angiographically negative, or SAH with normal or nondiagnostic angiography.[1-3] In some of these patients, the extravasated

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blood is typically confined to the cisterns surrounding the midbrain, it does not extend to the ventricular system or exit the posterior fossa, and the parenchyma is not affected. This pattern corresponds to the perimesencephalic subarachnoid hemorrhage (p-SAH).[4] A p-SAH pattern observed on initial computed tomography (CT) has a characteristically high predictive value for a normal angiographic study,[5] although aneurysm in the posterior circulation is responsible for the bleed in about 10% of cases.[5-7]

The p-SAH pattern is defined according to the Rinkel criteria for findings in simple cranial CT in the acute phase.[4] This pattern has been linked to an excellent long-term clinical prognosis, with a much lower complication rate than that of aneurysmal SAH.[5,8-15] Because of differences in behavior in the acute phase, and in medium- and long-term prognosis for these SAH patterns, skipping the second angiography has become a common practice in the management of these patients,[16,17] without new reports so far of any increases in long-term complications in p-SAH patients.[18]

However, there are also angiographically negative SAH cases in which the CT blood pattern is not confined to the basal cisterns (BCs) but extends to the ventricular system or peripheral locations such as the Sylvian fissure or the convexity. These cases do not therefore fulfill diagnostic criteria for p-SAH, and they have been referred to as nonperimesencephalic, aneurysm-like, or diffuse angiographically negative SAH. Although most of these cases are idiopathic, researchers have identified different etiologies, including hidden thrombosed or microscopic aneurysms that are not detectable by conventional angiographic techniques, as well as other less common causes such as arteriovenous malformations masked by vasospasm or a deep venous anomaly.[6,19-23]

In these patients, the diagnostic and therapeutic approach is less well defined. At present, it has not been conclusively shown that a negative angiographic study indicates that outcomes will be as favorable as in p-SAH. The studies published so far suggest that prognosis is poorer in these patients, but because the group is etiologically heterogeneous, treating patients on a case-by-case basis is recommended.

The aim of this study was to describe the demographic, clinical, radiologic, and prognostic features of angiographically negative cases of subarachnoid hemorrhage attended in a tertiary care hospital. By reviewing cranial CT studies performed in the acute phase, we can compare patients meeting the criteria for p-SAH to those who do not (np-SAH). We attempt to establish whether the latter is a distinct subtype of angiographically negative SAH.

Patients and Methods

We conducted a retrospective observational study based on data collected prospectively from all patients admitted to our hospital and diagnosed with SAH during the past 11 years. From among these patients, we selected those whose initial angiographic study was normal and categorized them as p-SAH or np-SAH using the criteria described by Rinkel et al[4] for the initial CT. According to those criteria, we excluded patients with acute CT performed after the first 72 hours. The Rinkel criteria specify that: (1) the center of the hemorrhage is located immediately anterior to the midbrain or brainstem with possible extension of blood to the anterior part of the ambient cistern or to the basal part of the Sylvian fissure; (2) no complete filling of the anterior interhemispheric fissure and no extension to the lateral Sylvian fissure, except for minute amounts of blood; (3) absence of frank intraventricular hemorrhage, except for minute amounts of blood; and (4) absence of intracerebral hematoma. Patients in whom CT was performed more than 72 hours after symptom onset were placed in the np-SAH group, and we indicated whether this was the reason for not meeting the Rinkel criteria. We also recorded the predominant location of bleeding in the np-SAH group and established 3 subgroups: bleeding mostly limited to BCs, convexity/cortical location, and intraventricular bleeding. Cases of SAH with negative CT findings (SAH diagnosed by cerebrospinal fluid analysis) was not included in this study.

We collected the baseline characteristics from both groups: sex, age, vascular risk factors, and previous antithrombotic treatment. We also recorded data describing clinical presentation: location and type of headache, associated symptoms, presence of meningeal signs, altered consciousness according to the Glasgow Coma Scale (GCS) and the Hunt & Hess (H&H) scale in the acute phase. Our team also analyzed the type and number of angiographic studies and administrative variables such as the admitting department and length of hospital stay.

To assess patient progress and prognosis, we registered the incidence of seizures, presence of decreased level of consciousness at time of admission, incidence of rebleeding, presence of vasospasm shown by ultrasound and angiography, presence of acute hydrocephalus (in patients requiring an external ventricular drainage [EVD]), cardiac electric conduction complications, electrolyte disturbances, and number of deaths. Clinical outcome at time of discharge was assessed on the GCS and H&H grades at discharge and the modified Rankin Scale (mRS) at 3 months.

The study is guided by the basic ethical principles in the Declaration of Helsinki. The highest standards of professional conduct have always been maintained, and patient confidentiality has been ensured at all times. It has