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Tomodensitometric Profile of Spontaneous Subarachnoid Hemorrhage (SAH) in Antananarivo

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Abstract

Introduction: The non-contrast brain CT scan is the first-line examination for the diagnosis of Subarachnoid Hemorrhage (SAH). Coupled with the CT angiography, it makes it possible to evoke an etiology and to guide the management of SAH. The objective of this study is to describe the tomodensitometric profile of SHA in Antananarivo.

Materials and Methods: This is a multicenter retrospective study of a series of 62 cases of SAH over a four-year period in two neurosurgery centers in Antananarivo.

Results: SAH was found in 60 patients, i.e. 96.77%. In two patients (3.23%), the diagnosis of HSA was made by lumbar puncture coupled by the "three tubes" test. Hydrocephalus was found in 30 patients or 48.39%. According to the modified Fisher classification; Forty-five percent had a grade 2, twenty five percent had a grade 1, and twenty percent had a grade 3. SAH was aneurysmal in 52 patients, or 83.87%, and non-aneurysmal in 10 patients, or 16.13%. Forty-three patients had a single aneurysm (82.69%) and nine patients (17.31%) multiple aneurysms. Aneurysms were small (< 6 mm) in 53.85% of patients. In descending order, the preferred localization was the bifurcation of the middle cerebral artery (38.46%), the anterior communicating artery (26.92%), the internal carotid artery (15.40%).

Conclusion: In the absence of arteriography, the CT scan associated with CT angiography still occupies a preponderant place in the positive and etiological diagnosis of SAH in low-income countries like Madagascar.

Keywords: *Antananarivo; Subarachnoid Hemorrhage; Madagascar; Spontaneous; Computed Tomography*

Introduction

Contrast-independent brain CT is the first-line examination for the positive diagnosis of subarachnoid hemorrhage (SAH). However, a scan can be normal in 3 to 5% of cases and this does not eliminate the diagnosis [1]. In front of a normal CT scan, especially after the sixth hour of the onset of symptoms [2,3], performing a lumbar puncture is desirable if there is no intracranial hypertension (IC-HTN). The diagnosis is evoked by the presence of a spontaneous hyperdensity in the subarachnoid spaces which is often located at the level of the tanks of the base of the skull, in the Sylvian valley or intra-ventricular. The brain scanner also makes it possible to establish the Fisher

classification and to diagnose the various complications of SAH such as hydrocephalus, intra-parenchymal hematoma, cerebral edema [1]. In Madagascar, because of the absence of arteriography, the etiological diagnosis of SAH is based on cerebral CT angiography. It allows locating an aneurysm, to measure the size of the sac and the neck, and to analyze the vascular relationship by a three-dimensional reconstruction [1]. The aim of this study is to describe the CT aspect of SAH.

Materials and Methods

This is a multicenter retrospective descriptive study of a series of 62 cases of spontaneous subarachnoid hemorrhage (SAH) over a period of 04 years from 01 January 2015 to 31 December 2018. This study was conducted in both departments Neurosurgery that supports vascular neurosurgery in Madagascar namely: the Department of Neurosurgery of the University Hospital Joseph Ravoahangy Andrianavalona and the Polyclinic Saint François d'Assise Antananarivo. Were included in our study, all patients were hospitalized in the neurosurgery department for the purpose of spontaneous SAH during our study period. All patients underwent a brain CT scan without contrast and a cerebral CT angiography. These are the parameters studied: the existence of SAH, the grade of FISHER, the existence of hydrocephalus. On CT angiography: the existence or not of aneurism; the size, number, location of the aneurysm. We used the modified Fisher classification, which is a tomodensotometric classification that quantifies the abundance of subarachnoid hemorrhage (annex). The different parameters were taken into account during the first admission of patients to the service. All data was collected from the medical records and the operating protocol book of both services.

Results

The average age of patients was 49.29 years with extremes of 25 and 77 years. The majority of patients (74.19%) were in the age group between 40 and 59 years old. We observed a predominance of the female gender is 50 women (80.65%) against 12 men (19.35%) with a sex ratio of 0.24.

SAH was found in 60 patients or 96.77%. In two patients (3.23%), the diagnosis of SAH was made by lumbar puncture coupled by the "three tubes" test. Hydrocephalus was found in 30 patients or 48.39%. According to the modified Fisher classification; forty-five percent had a grade 2, twenty five percent had a grade 1, and twenty percent had a grade 3 (Table 1). Three patients (4.83%) had ventricular flood (Fisher grade 4).

Fisher's rank	Staff n: 62	Percentage %
0	2	3,23
1	16	25,81
2	28	45,16
3	13	20,97
4	3	4,83

Table 1: *Patient Distribution by Fisher Grade on Non-Injection CT scan.*

SAH was aneurismal in 52 patients or 83.87% and non-aneurismal in 10 patients or 16.13%. Forty-three patients had a single aneurysm (82, 69%) and nine patients (17.31%) multiple aneurysms. Aneurysms were small (< 6 mm) in 53.85% of patients and between 6 and 10 mm in 30.77% (Table 2).

Size of aneurysms mm	Staff n = 52	Percentage %
< 6	28	53,85
6 - 10	16	30,77
11 - 20	7	13,46
20	1	1,92

Table 2: *Size of aneurysms on cerebral CT angiography.*

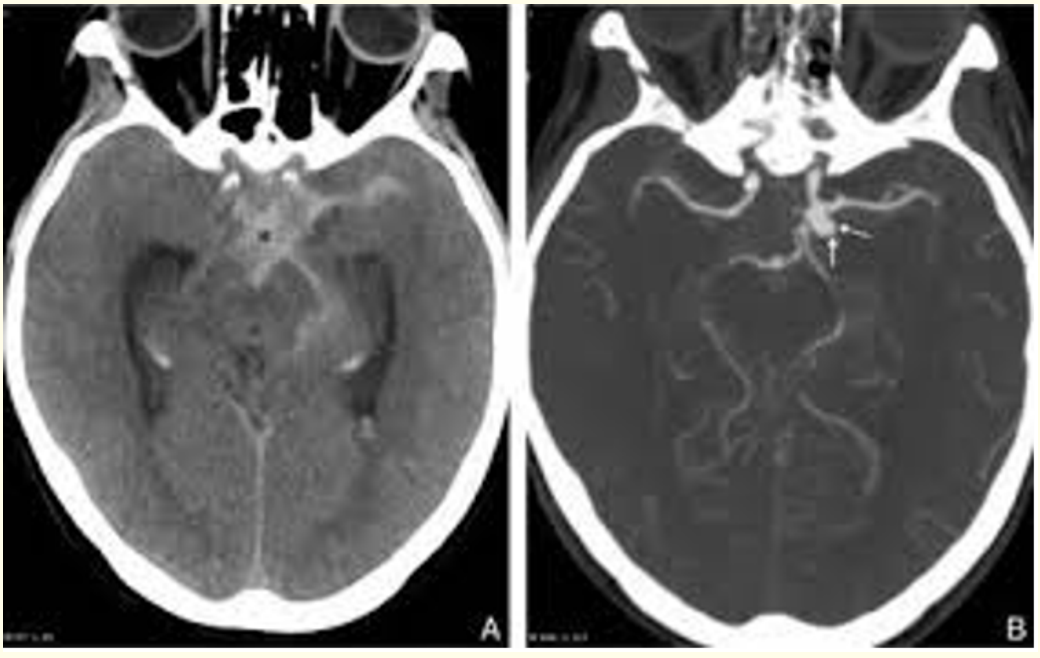

Figure A: *cerebral CT without injection of contrast agent showing SAH at basal skull cisterns and onset of hydrocephalus. B: Cerebral angiography CT of the same patient showing sacciform aneurysm at the left carotid terminus.*

The aneurysms were located mainly at the bifurcations and the communicating arteries. In descending order, the preferred localization was the bifurcation of the middle cerebral artery (38.46%), the anterior communicating artery (26.92%), the internal carotid artery (15.40%) (Table 3).

Localization of aneurysms	Staff n = 52	Percentage %
Middle cerebral artery bifurcation	20	38,46
Anterior communicating artery	14	26,92
Supra cavernous internal carotid artery	08	15,40
Middle cerebral artery M2	04	7,70
Basilar Artery	02	3,85
Posterior communicating artery	02	3,35
Posterior cerebral artery P1	02	3,84

Table 3: *Distribution of patients by location of intracranial aneurysm.*

Discussion

The sensitivity of the brain scanner for the diagnosis of SAH decreases with time; it was 96.77% in our series. For the remaining 3.23%, the diagnosis of SAH was made by a lumbar puncture coupled with the "three-tube test". In the Togolese series of Ahanogbe KMH., *et al*. [4], the sensitivity of the brain scanner was 93.10% and the diagnosis was established by lumbar puncture in 17.14% of patients.

The complication of SAH with hydrocephalus was present in 48.39% of our patients. The frequency of hydrocephalus on initial computed tomography is very variable according to the studies and it depends on the determining criteria used with a range from 6 to 67%. According to more recent studies, this frequency is 20 to 30% [5] and dependent shunt hydrocephalus accounts for 17.4% of cases [6].

The modified Fisher classification determines the abundance of SAH. In our series, 48.16% had a Fisher 2 grade. This result was different from that of Claassen J., *et al*. [7], which found a predominance of grades 3 (43%) and grades 1 (30%).

The sensitivity of cerebral CT angiography for the detection of intracranial aneurysm is 92.8 to 100% [8]; and its specificity is 83 to 100% [9-13]. The variability of performance is related to the material used and the type of population studied. In our two neurosurgery centers, the scanner used had 16 bars. SAH was aneurismal in 52 patients or 83.87% and non-aneurismal in 10 patients or 16.13%. This result was consistent with those reported by Song., *et al*. in a Chinese epidemiological study, which found 81.4% and 18.6%, respectively [14]. Intracranial aneurysms were predominantly single; only nine patients (17.31%) had multiple aneurysms. This figure differs little from the results of Song., *et al*. in 2017, which reported that aneurysms were multiple in 15.4% of patients [14].

Regarding the size of the aneurysm, we found a prevalence of aneurysms less than 6 mm (53.85%). This predominance is still low compared with the Rinke GJ study in 1998 [15], which recovered to 72%, because of the lack of sensitivity of CT angiography for aneurysms < 3 mm [16]. Aneurysms less than 10 mm account for 90% of cases [1].

The location of the aneurysms was very different according to the studies. In a systematic review of the literature [15,17] a preferred location of aneurysms in 31 - 42% of cases was at the level of the posterior communicating artery and the internal carotid artery. Aneurysms of the anterior communicating artery were between 24 to 30%. In the study by Song., *et al*. [14], the localization at the level of the anterior communicating artery represented 30,1%, that at the level of the communicating artery posterior 28,7% and that at the level of the cerebral artery average 15.9%. In our series, aneurysms were predominantly localized (38.46%) at the level of the bifurcation of the middle cerebral artery. The localization at the level of the anterior cerebral artery was 26.92%. Only two patients, 3, 35% had aneurysm in the posterior communicating artery.S

Conclusion

In the absence of arteriography, the cerebral CT scanner associated with CT angiography still occupies a prominent place in the positive and etiological diagnosis of SAH in low-income countries such as Madagascar. Magnetic Resonance Imaging (MRI) should be more accessible, since with some sequences it is more sensitive for the diagnosis of SAH.

Annex

Modified Fisher classification [7].

Grade	Criteria
0	No SAH or Intraventricular Hemorrhage (IVH)
1	Minimal/thin SAH, no IVH in both lateral ventricles
2	Minimal/thin SAH, with IVH in both lateral ventricles
3	Thick SAH,* no IVH in both lateral ventricles
4	Thick SAH,* with IVH in both lateral ventricles

Table

*Completely filling ≥ 1 cistern or fissure.

Conflict of Interest

The authors declare that they have no links of interest.

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