ORIGINAL ARTICLE

Topographic findings in patients with nontraumatic subarachnoid hemorrhage

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ABSTRACT

Introduction: cerebrovascular disease is the name given to conditions that cause a transient or permanent brain disorder caused by ischemia or hemorrhage secondary to a pathological process of the blood vessels of the brain.
Objective: to describe the tomographic findings in patients diagnosed with non-traumatic subarachnoid hemorrhage.
Methods: a descriptive, longitudinal, prospective research was conducted at the "Arnaldo Milián Castro" Hospital from January 2019 to March 2021. The population consisted of patients over 18 years of age with a diagnosis of non-traumatic subarachnoid hemorrhage seen in the Imaging Service who underwent simple tomography and angiotomography. Documentary analysis of the study record book of the Imaging Department and the individual clinical history were used; data were collected in a review guide.
Results: the patients studied were predominantly female and over 50 years of age. CT showed a high sensitivity in the diagnosis of the disease and its etiology and the cause was predominantly aneurysmal. Most aneurysms were saccular, medium-sized, with involvement mainly of the segment of the anterior communicating artery and bifurcation of the middle cerebral artery.
Conclusions: tomographic findings demonstrate the usefulness of simple tomography as the first study in case of suspected subarachnoid hemorrhage. The usefulness of angiotomography in the etiological diagnosis of subarachnoid hemorrhage is demonstrated.
Key words: non-traumatic subarachnoid hemorrhage; tomography; angiotomography

RESUMEN

Introducción: se conocen con el nombre de enfermedad cerebrovascular las afecciones que ocasionan un trastorno del encéfalo de carácter transitorio o permanente causado por isquemia o hemorragia secundaria a un proceso patológico de los vasos sanguíneos del cerebro.
Objetivo: describir los hallazgos tomográficos en pacientes con diagnóstico de hemorragia subaracnoidea no traumática.

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Métodos: se realizó una investigación descriptiva, longitudinal, prospectiva en el "Arnaldo Milián Castro" Hospital de enero de 2019 a marzo de 2021. La población estuvo constituida por pacientes mayores de 18 años con diagnóstico de hemorragia subaracnoidea no traumática atendidos en el Servicio de Imagenología a los que se realizó tomografía simple y angiotomografía. Se emplearon el análisis documental del Libro de registro de estudios del Departamento de Imagenología y la historia clínica individual, los datos se recolectaron en una Guía de revisión.
Resultados: en los pacientes estudiados predominó el sexo femenino y los mayores de 50 años de edad. La tomografía mostró una alta sensibilidad en el diagnóstico de la enfermedad y su etiología y predominó la causa aneurismática. La mayoría de los aneurismas fueron saculares, de mediano tamaño, con afectación principalmente del segmento de la arteria comunicante anterior y bifurcación de la arteria cerebral media.
Conclusiones: los hallazgos tomográficos demuestran la utilidad de la tomografía simple como primer estudio ante la sospecha de hemorragia subaracnoidea. Se demuestra la utilidad de la angiotomografía en el diagnóstico etiológico de la hemorragia subaracnoidea.
Palabras clave: hemorragia subaracnoidea no traumática; tomografía; angiotomografía

INTRODUCTION

Cerebrovascular disease (CVD) is the name given to conditions that result in a transient or permanent brain disorder caused by ischemia or hemorrhage secondary to a pathological process in the blood vessels of the brain.[1] It is a sudden loss of neurological function as a result of a focal alteration of cerebral blood flow due to ischemia or hemorrhage.[2]

Hemorrhagic CVD represents 20% of strokes, has a high mortality and is one of the most lethal in Intermediate Therapy Units. Intracerebral hemorrhage occurs in 10% of cases, while subarachnoid hemorrhage (SAH) represents between 5 and 10%.[3,4]

The worldwide crude incidence of SAH is 6.67 cases per 100,000 people; however, it varies in different regions of the world according to the World Health Organization.[5]

It is reported in China 2 cases per 100,000 population and in Western countries 6-8 cases per 100,000 population, while in Finland up to 22.5 cases per 100,000 population have been found. In the Americas the overall incidence is 6.67 cases per 100,000 people; specifically in the United States and Canada 5.67 cases per 100,000 inhabitants are reported and in South and Central America 4.2 cases per 100,000 people per year.[6]

In Cuba, in 2020, cerebrovascular diseases caused 5 618 deaths, for a rate of 100.9 per 100 000 inhabitants, in men and 5 203 deaths, for a rate of 92.4 per 100 000, in women. The risk of death is higher in male patients and in individuals aged 80 years and older.[7]

In the province of Villa Clara, in 2019, 668 people died from this cause, with a mortality rate of 85.9 per 100,000 inhabitants. According to the etiology of hemorrhagic cerebrovascular disease, 2,498 people died that year, which constituted 24.96% of deaths from this cause. In the male sex, 24.3 per 100 000 inhabitants died of hemorrhagic cerebrovascular disease, and in the female sex, 20.2 per 100 000 inhabitants. Among its causes, cerebral vascular aneurysms accounted for 7.3 per 100,000 inhabitants.[8]

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Imaging examinations have an important role in the diagnosis and treatment of these nosologic diseases. The Radiology Specialist must take into account the clinical aspects, be familiar with the radiological findings in order to establish the appropriate diagnosis and use a correct nomenclature.(9)
Among the methods for the study of SAH are the non-invasive ones:
Computerized axial tomography (CT) without contrast medium, important in the initial diagnosis of the hemorrhagic picture(10) and to assess its severity using the Fischer scale.(11) It has a sensitivity of 100% in the first six hours, if performed in the first 24 hours of the onset of symptoms, hyperdensity (blood in the subarachnoid space) can be observed in 90% of cases. This study, in addition to being diagnostic, has a great guiding value because it can visualize the site of major bleeding and even the possible etiological cause from the initial phase, it also gains importance in the diagnosis and evolution of complications.(10)
The non-invasive angiotomographic study (CT angiography) for the etiological study of the hemorrhagic picture is performed with 64-detector multislice equipment, covering the exploration from the aortic arch to the polygon of Willis, with intravenous contrast injection (80 to 100 ml, with a flow of four ml/sec, followed by serum washout). Preferably the contrast injection is performed in the left arm to avoid artifacts. Subsequently, 3D, volume rendering (VR) and maximum intensity projection (MIP) images are reconstructed at the workstation. This imaging technique is of great importance because it has great sensitivity and specificity in the etiological diagnosis of SAH, allows the definition of aneurysms of the polygon of Willis, carotid and basilar vertebral systems, as well as for the diagnosis of high-flow vascular anomalies.(12)
The Imaging Service of the "Arnaldo Milián Castro" Hospital has the necessary material and professional resources for the diagnostic approach to CVD; in this service, research is carried out to provide scientific evidence that strengthens and guides this activity. Because SAH is one of the diseases with the highest morbidity and mortality among cerebrovascular diseases and because CT and CT angiography are imaging studies of great importance in its diagnosis, it is necessary to corroborate the results of these studies in patients with suspected non-traumatic subarachnoid hemorrhage and to establish the relationship between the results of these angiographic examinations. The aim of this article is to describe the tomographic findings in patients with a diagnosis of nontraumatic subarachnoid hemorrhage.

METHODS

Design and population

A prospective, descriptive, longitudinal, prospective research was carried out in the Imaging Service of the "Arnaldo Milián Castro" University Clinical-Surgical Hospital of Santa Clara City, Villa Clara Province, in the period from January 2019 to March 2021.
The population consisted of all 56 patients over 18 years of age with a diagnosis of non-traumatic subarachnoid hemorrhage attended at the Imaging Service of the Hospital from January 2019 to March 2021 who underwent the

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first simple tomography and angiotomography performed between 14 and 21 days. No sample was selected because we worked with the total population.

Study variables

The following variables were operationalized: age, sex, latency time, imaging studies (simple CT and angiotomography), etiology of SAH (aneurysm, vascular anomaly, neoplasms and unspecified etiology), shape of aneurysms, size of aneurysms, neck diameter of saccular aneurysms, vascular segment affected, number of aneurysms, CT-angioCT ratio, complications and degree of severity.

Procedure, data collection and management

For data collection, the documentary review method was used; a Document Review Guide was used as an instrument. Data were collected from the Hospital Imaging Department's Study Record Book and from the individual clinical history of patients with subarachnoid hemorrhage.

For patients with a clinical diagnosis of non-traumatic subarachnoid hemorrhage, plain tomography was performed with a Philips® Somatom Definition AS tomograph with 128 detector rows, with a 3-mm slice interval in the axial slice plane; both sagittal and coronal multiplanar reconstructions (MPR) were performed.

Angiotomography was performed as soon as the clinical condition of the patients allowed it in order to know the etiology of the process.

The angiotomography study was performed with 64-detector multislice equipment covering the exploration from the aortic arch to the polygon of Willis. It was performed after sepsis and antisepsis of the puncture site, and a peripheral vein of the arm or forearm was cannulated. Twenty cc of physiological saline solution was administered prior to contrast administration. Intravenous contrast IOPAMIDOL-300 (80 to 100 ml) was administered, with a flow between 2.5 and 4 ml/sec between 10 and 30 sec, before administration it should be heated to 37 degrees to reduce its viscosity, then 20 cc of saline solution or injection water was administered. A Pitch of 2 (which is the ratio between the table advance and the complete rotation of the gantry) and a table movement speed (ratio between the distance to be covered by the table and the time the patient can be in apnea) are selected. The bolus tracking technique was used to achieve the optimal degree of enhancement of the arteries and the ROI was placed at the level of the descending aorta, and when it reached 120 HU it was triggered with a post-threshold delay of 4 sec. 1 mm thick axial slices were made. Subsequently, at the workstation, the images were reconstructed in 3D, volume rendering (VR) and maximum intensity projection (MIP).

Statistical analysis

The data were stored in an Excel file and exported to the SPSS 20.0 program for Windows 10. Absolute and relative frequencies were used to describe qualitative variables and the mean and standard deviation for quantitative variables. The relationship between variables was explored with the nonparametric test of independence. A significant relationship was inferred

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when the statistical significance "p" was less than 0.05 for a confidence level of 95%.

Ethical considerations

A commitment was made that the data obtained would be handled with discretion and professionalism, in accordance with the standards set forth in the Declaration of Helsinki, respecting the bioethical principles of Autonomy, Beneficence, Non-maleficence and Justice.

RESULTS

Fifty-six patients with SAH were included in the investigation: 29 (51.79%) female and 27 (48.21%) male. The overall mean age was 58 years±13; women 55±12 and men 60±14 years, with no significant differences (Student's t-test=-1.452; p=0.152).
Ages between 50 and 59 years were the highest percent (19, 33.93%), followed by ages between 60 and 69 (15, 26.79%) -Table 1-.

Table 1. Patients with nontraumatic subarachnoid hemorrhage by sex and age grouped together

Age grouped (years)	Gender				Total	
	Masculine		Feminine			
	No.	%	No.	%	No.	%
< 30	1	1.8	0	0.0	1	1.8
30 - 39	1	1.8	2	3.6	3	5.4
40 - 49	5	8.9	4	7.1	9	16.1
50 - 59	9	16.1	10	17.9	19	33.9
60 - 69	9	16.1	6	10.7	15	26.8
≥ 70	2	3.6	7	12.5	9	16.1
Total	**27**	**48.2**	**29**	**51.8**	**56**	**100**

Source: clinical records

Most patients were diagnosed before 24 hours (51, 91.1%) with simple CT and angiotomography was performed after 21 days (49, 87.5%). A small group of seven cases (12.5%) underwent angiotomography between 14 and 21 days because clinical and imaging conditions allowed it. The average time for simple CT was 15±11 hours and 24±2.5 days (Table 2).

Table 2. Latency time for plain CT and angiotomography of patients with nontraumatic subarachnoid hemorrhage

Latency time	No.	%	Average	Standard deviation
Simple CT				
< 24 hours	51	91.1		
24 - 72 hours	4	7.1	15 h	11 h
> 72 hours	1	1.8		
Angiotomography				
14 - 21 days	7	12.5		
> 21 days	49	87.5		
Total	**56**	**100**		

Source: clinical records

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Table 3 shows the distribution of patients with SAH according to etiology. It was found that in 47 patients (83.9%) the etiology was due to aneurysm, in seven (12.5%) it was unspecified, in three (5.4%) diagnosed with arteriovenous malformation (AVM) it was vascular anomalies with predominance of high-flow anomalies, in one case (1.8%) it was low-flow anomalies, which turned out to be due to cavernous angioma, and in only two cases it was due to neoplasms.

Table 3. Distribution of patients according to the etiology of SAH by angiography

Etiology of SAH			No.	%
Aneurysms			47	83.9
Vascular anomaly	High flow	AVM	3	5.4
	Low flow	Cavernoma	1	1.8
Neoplasms			2	3.6
Etiology unspecified			7	12.5
Total			**56**	**100**

Source: clinical records

Table 4 shows the patients with SAH with saccular aneurysm. There was a predominance of medium-sized aneurysms (24, 51.1%), 19 (40.4%) with a neck between 3 and 5 mm; followed in frequency by small aneurysms (16, 34.0%), nine patients (19.1%) with a neck smaller than 3 mm. Most large aneurysms (5, 10.6%) had a neck of 3 to 5 mm (4, 8.5%). Giant aneurysm was diagnosed in one case (2.1%), which presented a neck larger than 6 mm. Only one patient with fusiform aneurysm was diagnosed in the study.
There was a significant statistical association between saccular aneurysm size and neck diameter (X^2=0.4961; pX^2=0.0023).

Table 4. Relationship according to the shape and size of the saccular aneurysm neck by angiotomography study

Size of saccular aneurysm	Diameter of neck						Total	
	<3 mm		3 - 5 mm		≥ 6 mm			
	No.	%	No.	%	No.	%	No.	%
Small	9	19.1	6	12.8	1	2.1	16	34.0
Medium	3	6.4	19	40.4	2	4.3	24	51.1
Large	0	0.0	4	8.5	1	2.1	5	10.6
Giant	0	0.0	0	0.0	1	2.1	1	2.1
Total	**12**	**25.5**	**29**	**61.7**	**5**	**10.6**	**46**	**97.9**

Percentage with respect to total number of patients (47)
X^2=0.4961; pX^2=0.0023
Source: medical records

Regarding the size of the aneurysm and the vascular segment affected by angiotomography in patients studied, aneurysmal lesions in the anterior circulation (anterior communicating artery -ACoA-, posterior communicating artery -PCoA -, middle cerebral artery -MCA-, anterior cerebral artery -ACA-, bifurcation of the MCA and internal carotid -IC-) were frequent -45, 95.7%-; only in two cases (4.3%) aneurysms were found in territories related to the posterior circulation (basilar artery -BA- and posterior cerebral artery -PCA-). The most affected vascular segment was the MCA bifurcation (11, 23.4%), followed by the ACoA and MCA with 10 patients (21.3%) and seven cases

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(14.9%) with involvement of the ACA. There was no significant association between aneurysm size with the affected vascular segment pX^2=0.3006 (Table 5).

Table 5. Relationship between aneurysm size and vascular segment affected by angiotomography in patients with aneurysmal SAH

Affected vascular segment	Size of the aneurysm								Total	
	Small		Medium		Big		Giant			
	No.	%	No.	%	No.	%	No.	%	No.	%
ACoA	5	10.6	4	8.5	1	2.1	0	0.0	10	21.3
PCoA	1	2.1	2	4.3	-	-	0	0.0	3	6.4
MCA	2	4.3	4	8.5	1	2.1	1	2.1	10	21.3
ACA	2	4.3	3	6.4	2	4.3	0	0.0	7	14.9
Bifurcation of the MCL	4	8.5	5	10.6	1	2.1	0	0.0	11	23.4
IC	1	2.1	2	4.3	0	0.0	0	0.0	4	8.5
BA	0	0.0	0	0.0	1	2.1	0	0.0	1	2.1
PCA	0	0.0	1	2.1	0	0.0	0	0.0	1	2.1
Total	**15**	**31.9**	**21**	**44.7**	**6**	**12.8**	**1**	**2,1**	**47**	**100**

Percentage with respect to the total number of patients
X^2=0.4961; pX^2=0.0023
Source: medical records

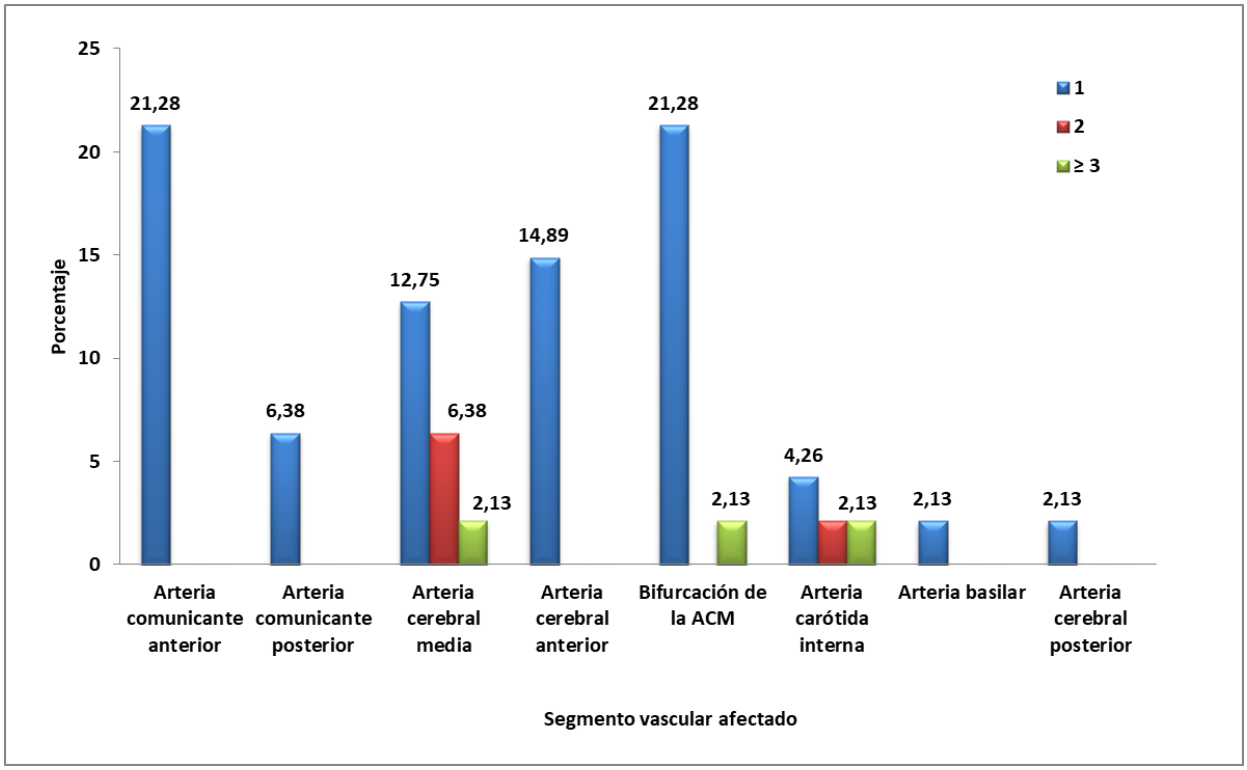

Figure 1. Affected vascular territory and multiplicity of aneurysms by angiotomography
Source: clinical records

Solitary aneurysms predominated (40, 85.11% of the total aneurysms) and within them those located in the segments of the anterior communicating artery and in the bifurcation of the middle cerebral artery with 10 cases each (21.28%). Three patients were diagnosed with multiple aneurysms, two with two aneurysms, which predominated in the middle cerebral artery (3, 6.38%), and one (2.13%) in the supraclinoid internal carotid artery. The patient with

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three aneurysms had one in the internal carotid segment, one in the MCA and the other in the bifurcation of the MCA. The segments most affected by multiple aneurysms were the MCA (4, 8.51%) and the supraclinoid carotid (2, 4.26%) -Figure 1-.

There was no significant statistical association between the affected vascular segment and the number of aneurysms, p=0.6139.

Most patients (50, 89.3%) had coincidence of imaging findings (CT and CT angiography). In a small group (six cases) no coincidence was found.

Figure 2 shows the complications reported by tomography and the degree of severity of SAH according to Fisher. A direct relationship was evidenced between the degree of severity of SAH and the occurrence of complications because the greatest number of complications manifested in patients with grade IV and III SAH.

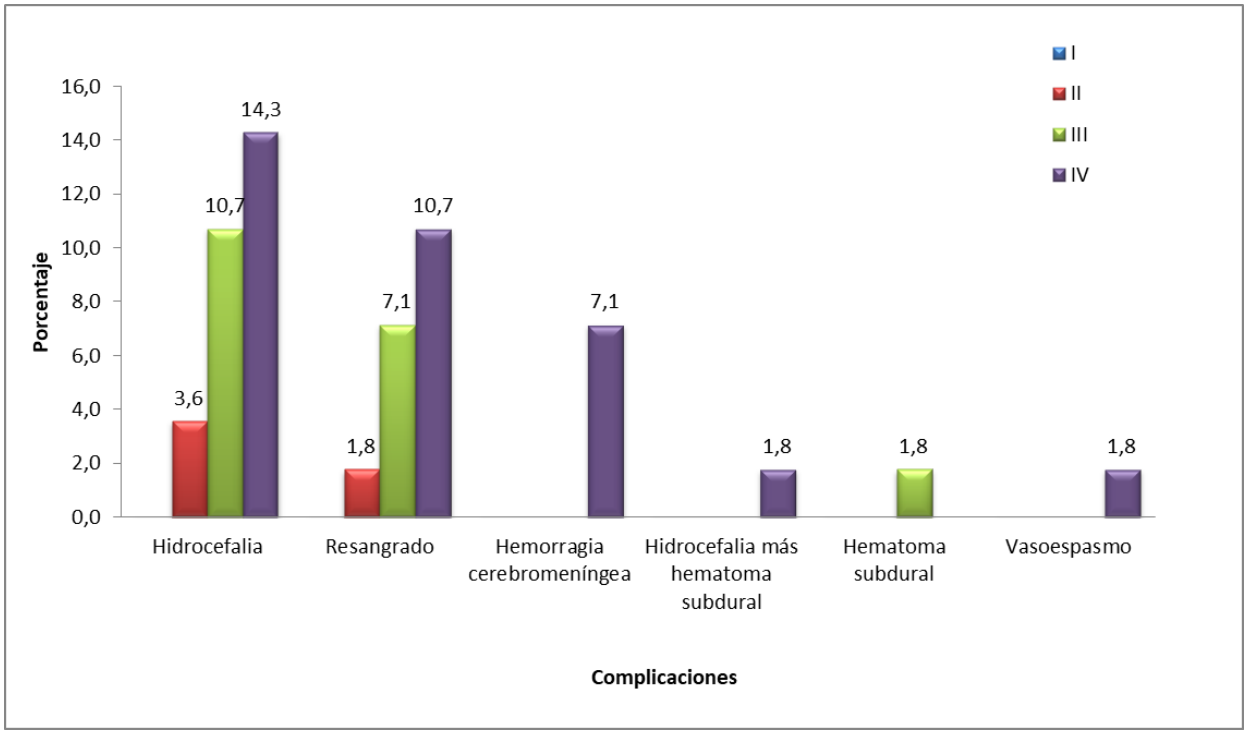

Figure 2. Complications and degree of SAH severity according to Fisher tomography
Source: clinical records

Among the main complications identified in patients with SAH in 16 (28.6%) was hydrocephalus, eight with grade IV (14.3%) and six with grade III (10.7%).

Rebleeding was reported as the second most frequent complication, with a total of 11 cases (19.6%), six (10.71%) with grade IV severity and four (7.14%) with grade III.

Cerebromeningeal hemorrhage complications occurred less frequently, with four patients (7.1%), all with grade IV, one case with hydrocephalus plus subdural hematoma, another with vasospasm (both with SAH grade IV) and one affected with subdural hematoma with SAH grade III.

It was shown that the most severe complications, cerebromeningeal hemorrhage and vasospasm, are associated with the most severe SAH (grade IV).

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DISCUSSION

Non-traumatic or spontaneous subarachnoid hemorrhage is one of the most devastating diseases today, representing a major health and economic burden worldwide and causing considerable disability and mortality.

Table 1 shows that among the patients with nontraumatic SAH included in the study, female sex predominated, discretely, and age between 50 and 59 years, results that coincide with those of a study of 343 patients with aneurysmal SAH in which age from 14 to 82 years, with a mean of 50±13 years, and female sex prevailed in 55.65%.[13]

A study of 318 patients with SAH due to ruptured aneurysm showed a median age of 53 years, with a minimum range of 19 years and a maximum of 89 years, and a predominance of female sex (62.4%).[14]

An investigation carried out in Camagüey Province on patients with non-traumatic SAH revealed that individuals older than 51 years represented 79%, that the most affected group was between 61 and 70 years of age (29%), very low incidence of individuals younger than 51 years and that the female sex was the most affected, with 66% over the male, 34%.[15]

The highest presentation of aneurysmal SAH occurs around the age of 55 years, an incidence that increases with advancing age;[16] furthermore, it is more frequent in women.[17]

The age above 50 years has also been reported by other authors,[18,19] which indicates that this is a complication that may be related to other age-related diseases such as hypertension and prolonged exposure to risk factors such as smoking and alcohol consumption.

The predominance of patients with middle age of life fits the main cause in the study which was aneurysmal. The literature suggests that in young people the most frequent cause of SAH is vascular malformation, whereas in middle age it is aneurysm and in old age arterial hypertension-arteriosclerosis.[20]

The results in Table 2 coincide with those of a study that suggests that the diagnosis should be timely, for which a non-contrast CT scan should be indicated within 24 hours of the patient's arrival at the emergency department. They state that the possibilities of each individual decrease as time goes by, i.e., the more days elapse after the stroke, the greater the number of complications for that patient and the lower the chances of improvement.[13] According to the authors, the hemorrhage should be treated as soon as possible to avoid future complications and to comply with the action protocols to avoid possible rebleeding.

An analysis of the main etiologies is shown in Table 3, which shows that the main causes of SAH were aneurysms and vascular anomalies, which coincides with a study on the clinical epidemiological behavior of non-traumatic SAH that found that aneurysms were the main etiology (83.92%), 13% were caused by arterial hypertension and 1.79% by venous malformations and hemorrhagic diathesis.[15]

The most frequent spontaneous SAH is due to aneurysm rupture (80-90% of cases). In the study performed, among the vascular anomalies, high-flow anomalies predominated, all related to AVM. The low incidence of low-flow anomalies is due to the low frequency of hemorrhagic complications and their symptoms, which makes their diagnosis, in most cases, a finding.[9]

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In the study, the frequency found was low based on the criteria of another author who states that cerebral arteriovenous malformations comprise a complex disease responsible for up to 38% of hemorrhages in patients between 15 and 45 years old and that each bleeding episode leads to 25 to 50% morbidity and 10 to 20% mortality.[21]

In a sample of 59 patients with SAH non-traumatic, there was evidence of arteriovenous malformation in only one patient, which corresponded to 2% of the total.[15] This low frequency is similar to that of the research under discussion.

In Table 4 of the research carried out, within the SAH of aneurysmal cause, the saccular ones predominated, above all those of medium and small size and, within them, those of neck between three and 5 mm. These results are similar to those of the literature, which states that saccular aneurysms are the most frequent at the cerebral level and that they occur at the bifurcation of vessels, which can be of variable size.[14,19,22,23]

Another study reports that in the treatment of intracranial aneurysms of the anterior circulation, 36.36% were small and 65.91% medium, which also shows a predominance of medium-sized aneurysms.[24] In the cases studied, aneurysms with necks between 3 and 5 mm predominated, with an average of 3.6 mm.

Table 5 shows that aneurysmal lesions were mainly evidenced in the segment of the anterior communicating artery and in the bifurcation of the MCA, which is consistent with the international literature that states that the distribution of aneurysmal locations mainly affects the anterior cerebral artery (from 31 to 36%), internal carotid artery (from 21 to 36%), middle cerebral artery (21%) and posterior circulation (from six to 10%).[25,26]

Other specific locations of ruptured cerebral aneurysms, in order of frequency, are the anterior communicating artery (35.88%), middle cerebral artery segment involvement (25.29%), and, in lower frequency, other locations.[13]

Regarding the location of the aneurysms, the greatest frequency was found in the posterior communicating segment of the internal carotid artery (32.9%), followed by the anterior communicating artery (21.1%) and the middle cerebral artery (20.7%).[14]

The predominance of aneurysms located in the posterior communicating artery has been determined (71.59%) and, in order of frequency, those of the middle cerebral artery (26.14%), those of the anterior cerebral-anterior communicating complex (14.77%), those of the carotid bifurcation (4.54%), those of the ophthalmic artery (4.54%) and those of the intracavernous carotid artery segment (1.13%). Aneurysms with neck between three and 5 mm predominate.[24]

Figure 1 shows the relationship between the vascular segment affected and the multiplicity of aneurysms by angiotomography. These results partially coincide with those of another study[27] in which 60% of patients had multiple aneurysms, most in the ophthalmic segment of the carotid artery, and the rest in other locations among which the posterior communicating artery and the anterior communicating artery were ruled out; the average number of sacs per patient with multiple aneurysms was 2.4% and in 12.7% more than two aneurysmal lesions were detected. Bilateral aneurysms (mirror twins) in the region of the ophthalmic artery were detected in 12% of the patients studied

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and 4% had infratentorial aneurysms (vertebral artery in the region of the posteroinferior cerebellar artery). All large or giant aneurysms in the supraclinoid region of the carotid artery were symptomatic. Incidental ophthalmic aneurysms were small, 83% linked to the origin of the ophthalmic artery. In this study of the 37 associated lesions 35 were small and 2 were large and no giant aneurysmal lesions were evident. In other previous studies, small aneurysms predominated in 72%, 20% were giant and 8% large.[28]

There was a relationship between the findings found in simple CT, in which the site of major bleeding or the possible etiology coincided, in most cases, with the findings of angiotomography, which corroborates the effectiveness of emergency CT for imaging diagnosis, results that coincide with those of another study.[14]

In a study performed with patients with aneurysmal SAH, the diagnostic coincidence between CT and CT angiography was total in 93.48% of the cases and partial in 6.52%.(27) Another study also shows a high correspondence of CT-CT angiography results in patients with non-traumatic SAH.[15]

In the case of aneurysmal SAH, CT angiography has shown a sensitivity for aneurysm detection of 98%, with a specificity close to 100%. False negatives in the interpretation of CT angiography are more frequent in the following situations: small aneurysms <3 mm in atypical locations, presence of vasospasm, thrombosed aneurysms, non-saccular aneurysms (dissecting aneurysms and blister aneurysms), and mycotic aneurysms.[29]

Complications in patients with non-traumatic SAH included in the study are shown in Figure 2. Complications identified as the most frequent were hydrocephalus and rebleeding; however, it should be noted that a significant number of patients did not present any complications.

The complications in patients with non-traumatic SAH included vasospasm (47%), seizures (14%), hydrocephalus (12%), and hyponatremia (11%).[15]

Other authors, when studying cases with aneurysmal SAH, found rebleeding as the main complication (8.74%),[13] and others evidenced complications such as rebleeding (21.1%), hydrocephalus (18.6%) and vasospasm (16.3%);[14] results coinciding with those of other research.[24].

The result of the research conducted coincides with the literature, which states that in the evolution of patients with SAH there are three probable circumstances that may appear and complicate the clinical course: rebleeding, vasospasm and hydrocephalus. The risk of rebleeding is 4% in the first 24 hours, to which is added 1.5% per day, up to approximately 20% in the first 15 days. The risk is maintained and is 50% in the first month and 78% at six months.[30]

Vasospasm appears in 50% of cases and is more frequent between days 4 and 10 after SAH. About 25% develop ischemia or infarction with severe neurological deficits. In itself, it has a mortality rate of approximately 10%. With vasospasm, 70% of patients may develop arterial narrowing and only 20-30% manifest neurological deficits or die despite adequate therapy.[30]

Hydrocephalus is caused by blood in the subarachnoid space. It is common following subarachnoid hemorrhage and may present acutely or insidiously over days, weeks, or months. Hydrocephalus following subarachnoid hemorrhage can take two forms: communicating hydrocephalus due to blockage by blood or by-products or sclerosis of the subarachnoid spaces or

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obstructive, caused by direct intraventricular obstruction at the level of the orifices of Monro, Luschka or Magendie.[1,2]

CONCLUSIONS

Patients with nontraumatic subarachnoid hemorrhage had a similar distribution according to sex, with a slight female predominance, and the greatest number were over 50 years of age. The main cause of subarachnoid hemorrhage was aneurysmal. Most of the aneurysms were medium-sized saccular, with involvement mainly of the segment of the anterior communicating artery and bifurcation of the middle cerebral artery. The usefulness of angiotomography in the etiological diagnosis of subarachnoid hemorrhage is demonstrated. The findings found in the first tomography and angiotomography demonstrate the usefulness of simple tomography as the first study in the case of suspected subarachnoid hemorrhage.

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CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

CONTRIBUTION OF THE AUTHORS

YRA: conceptualization, data curation, formal analysis.
BJM, YHG: writing (proofreading and editing).
YVM: conceptualization, data curation, formal analysis, writing (proofreading and editing).
IME: methodology, supervision, validation, visualization, writing of the original draft.
RCD: validation, visualization, writing the original draft, research.

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