ORIGINAL ARTICLE

DEFINITIVE TREATMENT OF CEREBRAL ANEURYSMS AT THE CAYETANO HEREDIA NATIONAL HOSPITAL IN LIMA PERU: A CASE SERIES RESULTS

Tratamiento definitivo de aneurismas cerebrales en el Hospital Nacional Cayetano Heredia en Lima Perú: Resultados de una serie de casos

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ABSTRACT

Objectives: Subarachnoid hemorrhage (SAH) due to rupture of a cerebral aneurysm continues to be a disease with high morbidity and mortality in our setting, despite advances in microsurgery and endovascular therapy. The objective of the present study was to determine the demography, vascular territory, and complications that occur in the perioperative management of patients with ruptured cerebral aneurysms treated at the Cayetano Heredia Hospital.
Methods: An observational descriptive study of patients with cerebral aneurysm undergoing surgical and endovascular treatment was carried out in the Neurosurgery Service of the Cayetano Heredia Hospital from 2016 to 2018. The clinical records and operative reports were reviewed.
Results: In a period of 30 months, definitive treatment was performed in 56 patients with a diagnosis of a ruptured cerebral aneurysm, of which 5 received endovascular treatment and 51 treatment by craniotomy and clipping. 62.5% were women, and 50% of the total were between the fifth and sixth decade of life. In more than 50% of cases, treatment was performed within 96 hours of SAH. Regarding the affected arterial territory, 15 patients (27%) had an aneurysm of the territory of the anterior communicating (AComA) and another 15 (27%) in the posterior communicating artery (PComA). Mortality was 17.8%, 70% being due to direct causes such as cerebral infarction and severe vasospasm.
Conclusions: The treatment of the aneurysms was mainly by microsurgery, the aneurysms of the AComA, PComA, and middle cerebral (MCA) had a similar proportion and, in more than 50% the treatment was carried out in the first 4 days. More state support is required to increase endovascular therapy and obtain more promising results.

Keywords: *Intracranial Aneurysm, Microsurgery, Craniotomy, Endovascular Procedures (source: MeSH NLM)*

RESUMEN

Objetivos: La hemorragia subaracnoidea (HSA) por ruptura de un aneurisma cerebral sigue siendo una enfermedad con una elevada morbimortalidad en nuestro medio, pese a los avances en microcirugía y en terapia endovascular. El objetivo del presente estudio fue determinar la demografía, territorio vascular y las complicaciones que se presentan en el manejo perioperatorio de los pacientes con aneurisma cerebral roto tratados en el Hospital Cayetano Heredia.
Métodos: Se realizó un estudio descriptivo observacional de pacientes con aneurisma cerebral sometidos a tratamiento quirúrgico y endovascular en el servicio de Neurocirugía del Hospital Cayetano Heredia desde el 2016 al 2018. Se revisaron las historias clínicas y los reportes operatorios.
Resultados: En un periodo de 30 meses se realizó tratamiento definitivo a 56 pacientes con diagnóstico de aneurisma cerebral roto, de los cuales 5 recibieron tratamiento endovascular y 51 tratamiento mediante craneotomía y clipaje. El 62.5% fueron mujeres, y el 50% del total estuvieron entre la quinta y sexta década de la vida. En más del 50% de los casos, el tratamiento se realizó dentro de las 96 horas de producirse la HSA. Respecto al territorio arterial afectado, 15 pacientes (27%) tuvieron un aneurisma del territorio de la comunicante anterior (AComA) y otros 15 (27%) en la comunicante posterior (AComP). La mortalidad fue del 17.8% siendo el 70% debido a causas directas como infarto cerebral y vasoespasmo severo.
Conclusiones: El tratamiento de los aneurismas fue principalmente por microcirugía, los aneurismas de la AComA, AComP y cerebral media (ACM) tuvieron una proporción similar y, en más del 50% el tratamiento se realizó en los 4 primeros días. Se requiere mayor apoyo del Estado para incrementar la terapia endovascular y obtener resultados más prometedores.

Palabras clave*: Aneurisma Intracraneal, Microcirugía, Craneotomía, Procedimientos Endovasculares (Fuente: DeCS Bireme)*

Peru J Neurosurg 2021, 3 (1): 13-22

Submitted *: September 21, 2020*
Accepted *: December 30, 2020*
HOW TO CITE THIS ARTICLE: Rojas G, Garay H, Alaba W, Rodríguez C, Lovatón R, Huamán R. Definitive treatment of cerebral aneurysms at the Cayetano Heredia National Hospital in Lima Peru: A case series results. *Peru J Neurosurg 2021; 3(1): 13-22*

Ruptured brain aneurysms are an emergency and have a great impact on society. The incidence of subarachnoid hemorrhage (SAH) varies from 2 to 16 per 100,000 inhabitants.[1] There are different theories that explain the pathophysiology of a brain aneurysm, from that in which the origin is found in smooth muscle cells with defective collagen synthesis,[2] to cellular (T cells, B cells) and molecular (IL-6, the antagonist of IL-1R and TNF-α) inflammatory processes that occur in subarachnoid hemorrhage.[3]

The cerebral aneurysm affects women more frequently, the age group with the highest prevalence being those under 60 years of age. As risk factors, tobacco use, and high blood pressure have been clearly associated. [1, 4, 5, 6] The most frequent location of a cerebral aneurysm is in the territory of the anterior circulation followed by that of the posterior circulation (83% and 17%); the most frequent exact location is the anterior communicating artery, where 40.41% of all aneurysms of the anterior circulation are found. [7]

Among the complications of SAH we have acute and late hydrocephalus, epileptic seizures, rebleeding, vasospasm, cerebral infarcts, and infections. The treatment of SAH has improved over the years and today there is lower mortality, a greater number of treatments due to new technological advances, and a greater variety of supplies for both endovascular and microsurgical treatment, all of which has resulted in an earlier resolution of the aneurysmal rupture and in less time of hospitalization.[8] In the recommendations of the American Heart Association of 2012, the determination of the treatment of the aneurysm is given by the surgical or endovascular experience of the neurosurgeons and must be multidisciplinary in as much as possible according to the type of patient and characteristics of the aneurysm. [1]

There are few studies carried out in our hospital on the management of ruptured brain aneurysms. J. Flores et al [9] found that, of a total of 22 patients with cerebral aneurysms operated on in the Neurosurgery Service in 2009, 6 patients were selected for the pterional keyhole approach and 16 for the classic Pterional approach. There are no studies that reveal associated risk factors in our hospital setting, or follow-up studies for postoperative controls.

The objective of this study is to have information on risk factors associated with cerebral aneurysms in our environment, to know the characteristics of the treated aneurysms and compromised arterial territories, and to make comparisons in subsequent studies.

METHODS

A descriptive case series study was carried out based on a total of 56 patients diagnosed with ruptured cerebral aneurysm who underwent microsurgical clipping of the aneurysm or endovascular treatment with coils, at the Neurosurgery Service of the Cayetano Heredia National Hospital from 2016 to 2018 (30 months of study). Data collection was based on a detailed review of medical records (hospitalization and intensive care), operative reports, and epicrisis.

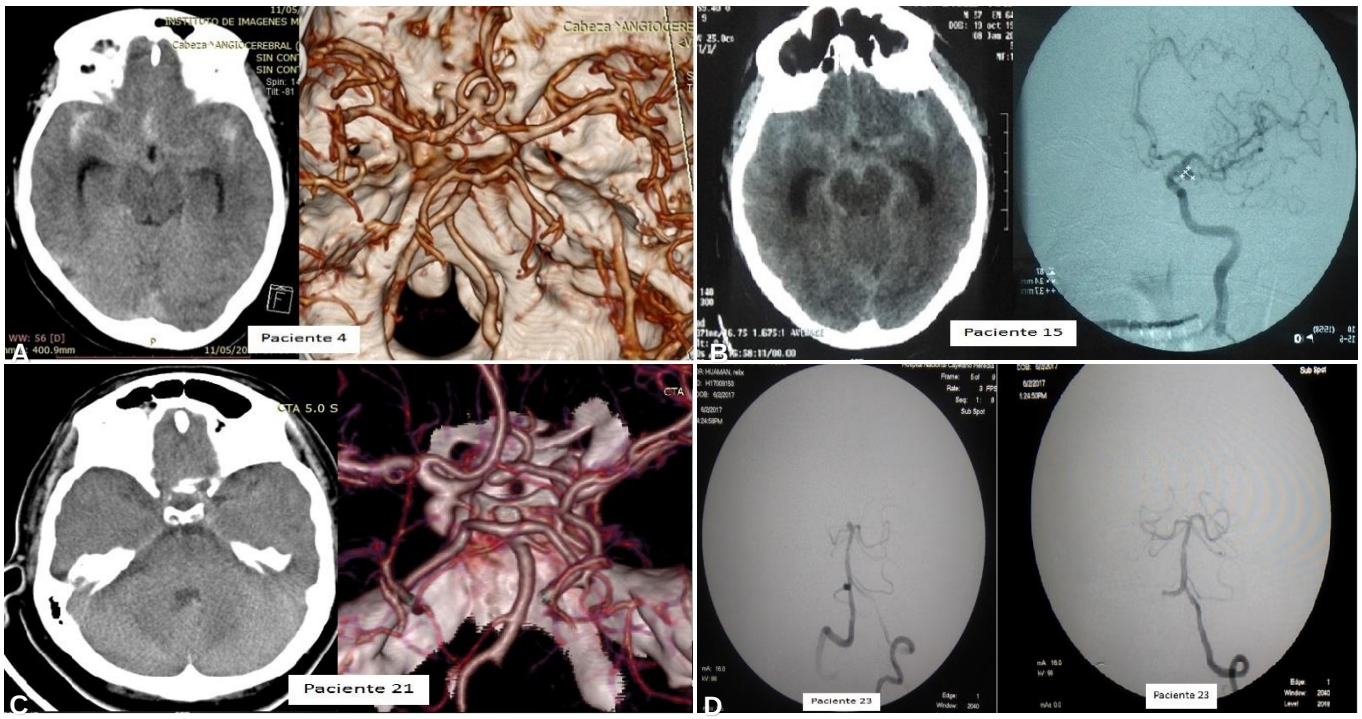

Fig 1. Computed tomography (CT), angioCT, and angiography of patients with cerebral aneurysms. **(A)** Brain CT showing SAH Fisher III. Brain angioCT showing an aneurysm in AComA. **(B)** Brain CT showing SAH Fisher III. Cerebral angiogram showing an unruptured left PComA aneurysm. **(C)** Brain CT showing SAH Fisher II. Brain angioCT showing a ruptured left PComA aneurysm and an unruptured AComA aneurysm. **(D)** Cerebral angiogram showing upper basilar aneurysm. Post-embolization control angiography with coils showing complete exclusion of the aneurysm.

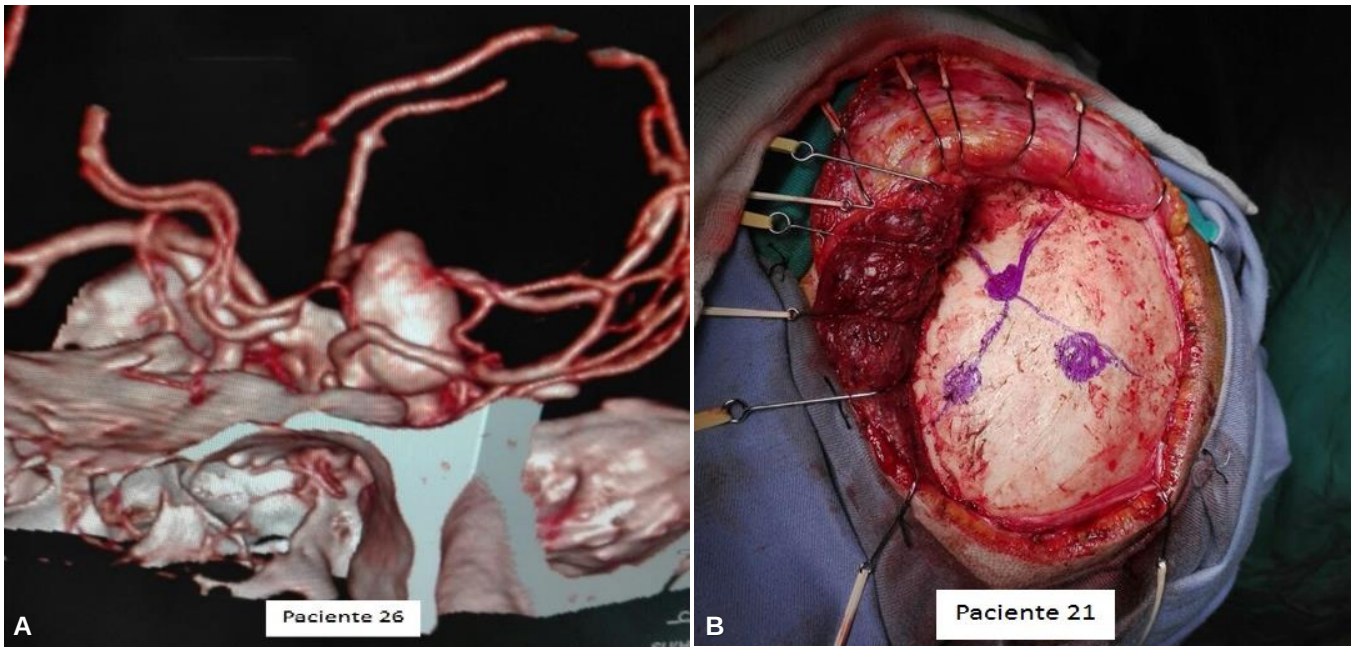

Fig 2. **(A)** Brain angioCT showing an aneurysm of the choroidal segment of the left ICA. **(B)** Pterional craniotomy that allowed the aneurysm to be clipped.

Diagnosis and preoperative studies

All patients were evaluated according to clinical and imaging criteria, initially being treated by the Emergency Service. Each patient was assigned an order number according to the time of arrival to the Cayetano Hospital.

In the preoperative evaluation by the neurosurgeon, the data about the Hunt Hess Scale, the Glasgow Coma Scale at admission, and the Fisher scale were collected. The Fisher scale assesses the degree of SAH in a non-contrast tomography.

All patients underwent a brain angiography with 3D reconstruction or a cerebral angiography to define the location and characteristics of the ruptured brain aneurysm. *(Fig 1)*

Surgical technique

After being evaluated and prepared by the anesthesiology team, the patient is placed supine with the head fixed with a pinhead and lateralized according to the location and direction of the aneurysm to be treated. Then, according to the standard technique, the surgical area is asepsis and antisepsis (with iodine solution) and the area is covered with sterile drapes. A classic or expanded pterional craniotomy is performed depending on the case, being necessary on some occasions based on the clinical condition of the patient, a decompressive craniectomy due to the great cerebral edema. Different types of approaches were performed according to the preference of the neurosurgeon such as a subfrontal approach, a transylvian approach, and an anterior temporal approach. *(Fig 2)*

Statistical analysis

Being a descriptive case series study, the results are presented as numbers and percentages in tables and graphs.

RESULTS

A series of 56 patients with ruptured cerebral aneurysms operated in our hospital during the study period is presented. ***Table 1*** shows that 37.5% correspond to the male gender and 62.5% to the female gender; also 50% of patients are between the 5th and 6th decade of life. Of the 56 patients, 27 (48.2%) underwent emergency surgery and 29 (51.8%) patients underwent elective surgery, prioritizing them over other cases also scheduled for elective surgery *(Fig 3 A)*

Table 1: Distribution by age and sex of patients with brain aneurysms at Cayetano Heredia Hospital, Lima Peru, 2016-2018.

	Sex		TOTAL
Age	**Male**	**Female**	**No (%)**
10-19	0	01	01 (1,8%)
20-29	0	03	03 (5,4%)
30-39	03	03	06 (10,7%)
40-49	04	06	10 (17,8%)
50-59	05	09	14 (25%)
60-69	06	08	14 (25%)
> 70	03	05	08 (14,3%)
TOTAL	**21**	**35**	**56 (100%)**

Source: *Database of the Neurosurgery Service of the Cayetano Heredia National Hospital*

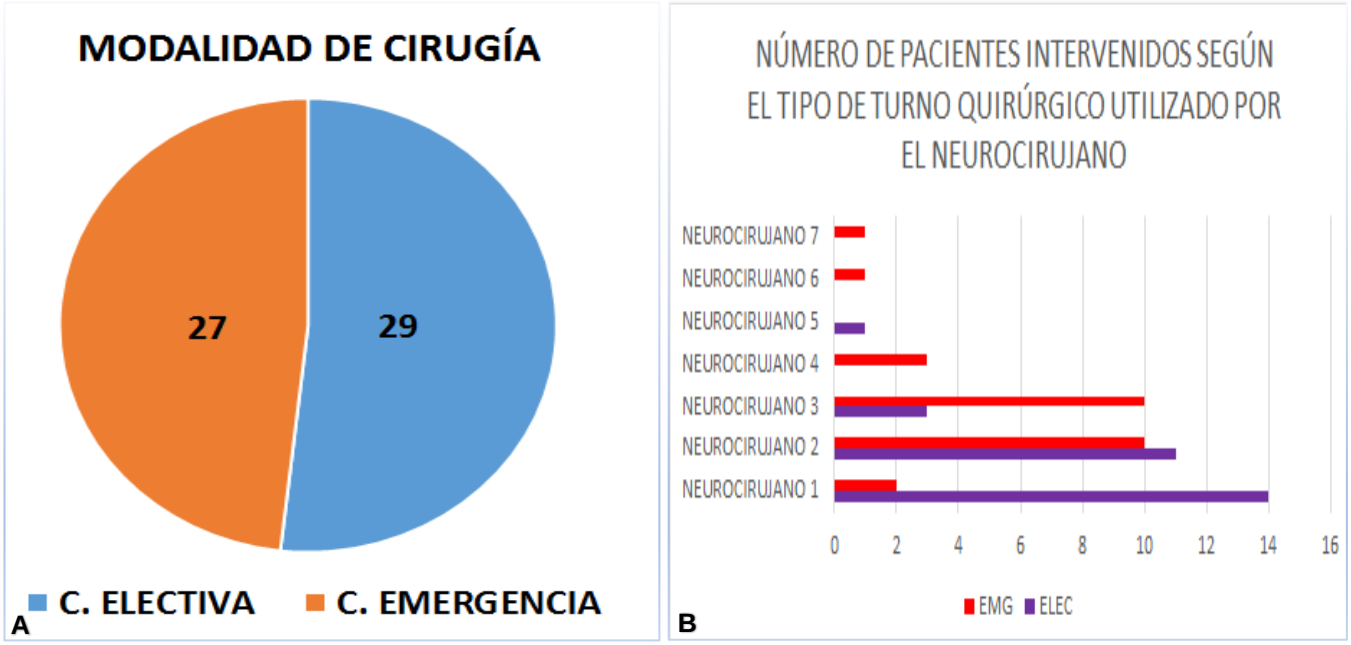

Fig 3. **(A)** Mode of surgery used in the treatment of brain aneurysms. **(B)** Number of patients treated according to surgical modality and Neurosurgeon.

The interventions were carried out by 7 different Neurosurgeons, each one with a different number of operated patients. The maximum number of operated patients corresponds to "Neurosurgeon No 2" with a total of 21 operated patients, and the minimum number of operated patients corresponds to "Neurosurgeons No 5, 6, and 7", with 1 patient each. *(Fig 3B)*

According to the arterial segment affected, 15 patients had an aneurysm in the segment of the anterior communicating artery (AComA) and another 15 patients in the posterior communicating artery (PComA), corresponding to 27% each. In the segment of the middle cerebral artery (MCA) an aneurysm was found in 14 patients, corresponding to 25%. *(Fig 4A)*

Regarding the form of treatment of ruptured cerebral aneurysm, microsurgical treatment with aneurysm clipping was the most frequent (91% of cases); while endovascular treatment corresponded to the remaining 9%. The latter was carried out in its entirety by "Neurosurgeon No. 2", with a total of 5 patients all being operated on in the form of elective surgery. *(Fig 4B)*

Table 2 shows the gender and age of the patients in relation to the location of the aneurysm. It is appreciated that that of the female sex is predominant in all affected arterial segments. It is also shown that between the 5th and 6th decades the AComA and MCA segment predominates. The most frequent grade on the Hunt and Hess scale at admission was grade II (53%), followed by grade III (20%). The least frequent grade was grade V (9%) (Fig 5A)

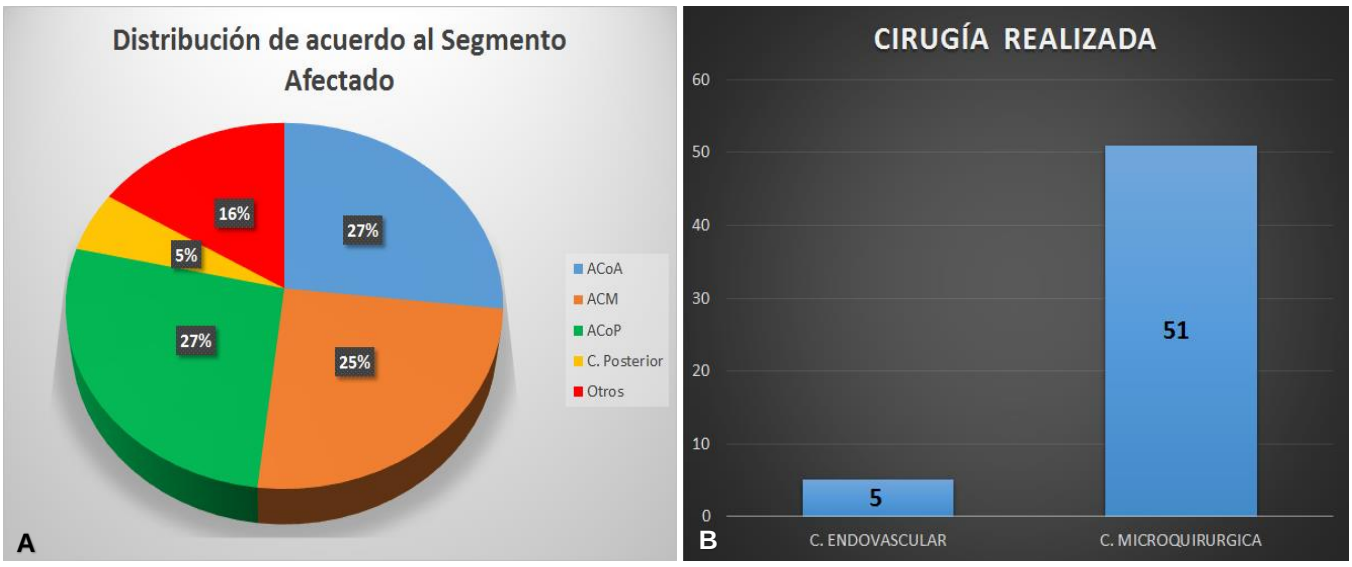

Fig 4. **(A)** Arterial segments affected in patients treated for cerebral aneurysms. **(B)** Type of technique used in the treatment of cerebral aneurysms.

Table 2: Demographics characteristics as sex and age according to aneurysm location in patients treated with ruptured cerebral aneurysm at Cayetano Heredia National Hospital, Lima Peru, 2016-2018.

	Location					Total	
	AComA	AComP	MCA	Posterior C.	Other	N	%
Sex							
Male	07	05	05	01	03	21	37.5%
Female	08	10	09	02	06	35	62.5%
AGE (years)							
10-19	0	01	0	0	0	01	1.8%
20-29	0	02	0	0	01	03	5.4%
30-39	01	01	02	0	02	06	10.7%
40-49	02	02	03	01	02	10	17.8%
50-59	04	04	03	0	03	14	25%
60-69	05	01	05	02	01	14	25%
> 70	03	04	01	0	0	08	14.3%
TOTAL	**15**	**15**	**14**	**03**	**09**	**56**	**100%**

Source: *Database of the Neurosurgery Service of the Cayetano Heredia National Hospital*

Table 3 shows the relationship of the Fisher scale and the waiting time for surgery with the location of the aneurysm. 82.1% correspond to the Fisher scale III and IV and in more than 50% of the patients, the treatment was carried out within 96 hours of the occurrence of the subarachnoid hemorrhage event.

Regarding the relation of the day of intervention and the neurosurgeon (nominated from 1 to 7), it was found that more than 50% of the patients were operated on between day 1 and 4 of SAH, with the earliest day of an intervention being day 1 corresponding to the "Neurosurgeon 2" and to "Neurosurgeon 6" (1 patient). The latest days (after day 21 of the SAH) corresponded to "Neurosurgeon 1" in patients No 34 and 56 (day 28 and 65 respectively), to "Neurosurgeon 2" in patients No 1, 7, and 25 (day 117, 28, and 27 respectively) and finally to "Neurosurgeon 3" in patients No 41 and 50 (day 81 and 31 respectively). This occurred due to 3 main factors: First, the precarious Health System in our country, for example, patient No 01 underwent surgery on day 117 of HSA due to the delay of the SIS to buy the necessary aneurysm clip for his surgery; second, to difficulties for an accurate diagnosis due to the lack of the Hospital's own tomograph whose 3D impressions were of poor quality; and finally, the clinical status of the patient, for example, the

Table 3: Fisher scale and surgical waiting time according to aneurysm location in patients treated with ruptured cerebral aneurysm at Cayetano Heredia National Hospital, Lima Peru, 2016-2018.

	Location					Total	
	AComA	AComP	MCA	Posterior C.	Other	N	%
FISHER SCALE							
I	01	0	0	0	0	01	1.8%
II	01	01	05	0	02	09	16.1%
III	04	09	06	0	04	23	41.05%
IV	09	05	03	03	03	23	41.05%
SURGERY WAITING TIME							
<96 hours	06	09	07	01	06	29	51.8%
>4-14 days	06	03	05	02	02	18	32.1%
>14 days	03	03	02	0	01	09	16.1%
TOTAL	**15**	**15**	**14**	**03**	**09**	**56**	**100%**

Source: *Database of the Neurosurgery Service of the Cayetano Heredia National Hospital*

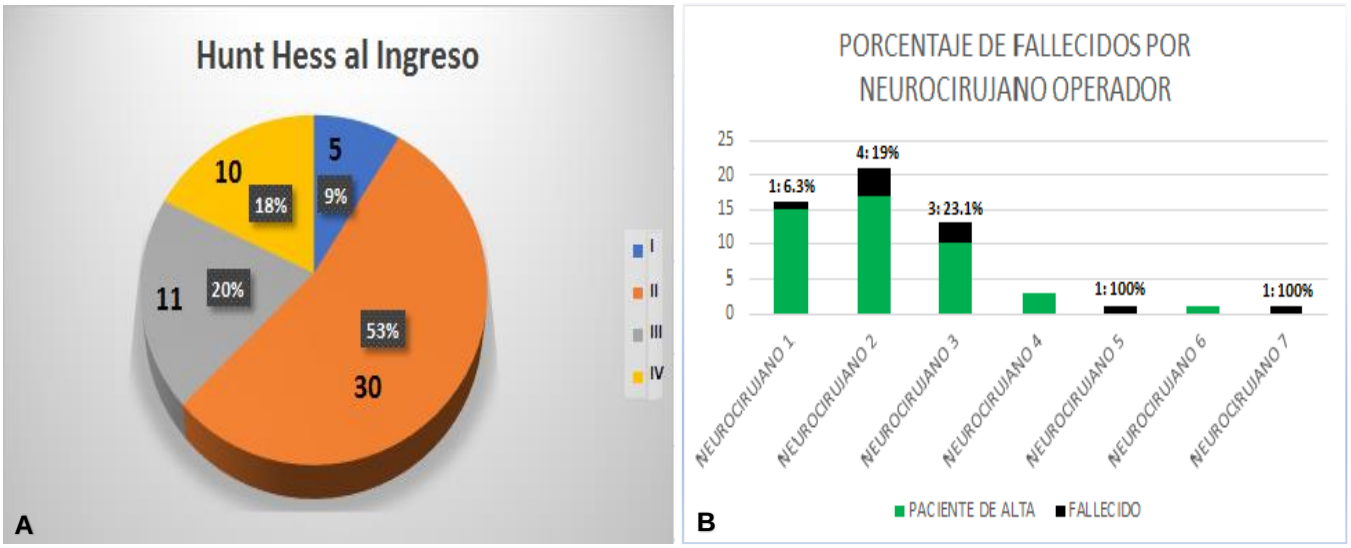

Fig 5. (A) Patients treated for cerebral aneurysms according to the Hunt & Hess scale. **(B)** Deceased patients treated for cerebral aneurysms according to the Neurosurgeon.

patient No. 41 underwent surgery on day 81 of SAH because, it had to wait for the improvement of the critical clinical picture in which he was found, which happily resolved favorably. *(Fig 6)*

Table 4 shows postoperative complications and mortality in patients with a ruptured cerebral aneurysm. Mortality was 17.8% and the most frequent complications were nosocomial infections and cerebral infarcts (associated with vasospasm) that corresponded to 16.1% each. One patient (No 10) died in the operating room.

Regarding the percentage of deaths according to the operating neurosurgeon, it was found that of the 5 patients who underwent endovascular treatment, one died (the patient No. 35) due to the complication of acute hydrocephalus. *(Fig 5B)*

Table 5 shows the probable causes of death in patients with ruptured cerebral aneurysm and their relationship with the day of the intervention and the Hunt Hess scale on admission. Postoperative rebleeding occurred in 2 cases (patients 51 and 54) and preoperative rebleeding occurred in 4 patients (numbers highlighted in **bold**).

One patient (patient 31) had a residual aneurysm evidenced by a postoperative 3D tomography angiography; however, the relatives requested voluntary removal, so it was not possible to continue the follow-up. Also, there were 2 cases of giant aneurysms (patients 26 and 31) which, however, did not have a favorable clinical evolution.

Table 4: Postoperative complications of patients with ruptured brain aneurysm operated at Cayetano Heredia Hospital, Lima Peru, 2016-2018.

	Patients	
	N	%
POSTOPERATIVE COMPLICATION		
Infarction	09	16.1%
Early Hydrocephalus	04	7.2%
Late Hydrocephalus	04	7.2%
Infections	09	16.1%
Death	10	17.8%
Rebleeding	02	3.6%

Source: *Database of the Neurosurgery Service of the Cayetano Heredia National Hospital*

Table 5: Complication as a probable cause of death according to the day of surgery and the Hunt and Hess scale in patients operated on for cerebral aneurysm at the Cayetano Heredia Hospital, Lima Peru, 2016-2018.

	Patients		
	N	Surgery day	Hunt Hess
COMPLICATION AS A CAUSE OF DEATH			
Malignant brain infarction	02	**7** and 10	**II**, IV
Acute hydrocephalus	02	2 and 4	IV, III
Nosocomial infection	02	**2** and **28**	**IV**, **III**
Postoperative rebleeding	02	**12** and 3	**II**, III
Unknown cause and/or cardiorespiratory arrest	02	3 and 2	III, II

Source: *Database of the Neurosurgery Service of the Cayetano Heredia National Hospital*

DISCUSSION

On average, more than 22 patients undergo surgery per year, which is in accordance with what is recommended by the guidelines and commented on by other authors.[1,10] Our study shows gender and age group characteristics comparable to those of other studies conducted in Peru, where the highest frequency is in women and the highest prevalence in those under 60 years of age. [4, 5, 6]

In our setting, the shifts for elective neurosurgery are limited, so emergency shifts are used to resolve urgent pathologies; on the other hand, the resolution of vascular pathology such as brain aneurysms is carried out by a general neurosurgeon, in contrast for example to England where they have 20 vascular neurosurgeons and 16 interventional neuroradiologists in seven neurosurgery units who treat SAH every day of the week. [11]

Regarding the comparison between microsurgical treatment or vs endovascular treatment, the large studies of the Barrow Institute and the large ISAT study advise conducting a new prospective trial by "intention to treat", this being the only way to provide a credible answer on what management method provides the best long-term result. ISAT has a slightly inclined result towards endovascular management and the Barrow has a slight inclination towards microsurgery. [12, 13]

In American studies such as the Barrow Institute, the prevalence of cerebral aneurysms is higher in the anterior circulation, especially in the segment of the anterior communicating artery.[7] This differs from the prevalence in studies in Peru, as shown by the study by Rocca et al, where In his study of patients operated on at the Guillermo Almenara Hospital from 1983 to 2001, he found that the most frequent location was the posterior communicating artery, [4] whose results are similar to that of the Edgardo Rebagliati Hospital with 37.3% [5] and those of the Sabogal Hospital. with 49.25% in this segment,[6] in contrast to what was found at our headquarters, where the highest proportion was from both the posterior communicating segment and the anterior communicating artery.

The results of the Hunt Hess grade ≤ II corresponding to 62% and a HH ≥ III corresponding to 38% are comparable with other studies in Peru and South America. [4, 5, 6, 14] The predominant Fisher scale, which was grade III and IV, is also comparable with a study from our country,[6] unlike another in which grade I was the most predominant. [4]

Our hospital center serves the northern part of Lima, where the population tends to go to the hospital late, late diagnoses added to the lack of supplies and the little suspicion of subarachnoid hemorrhage in primary care does not allow early (ultra-early) treatment ruptured cerebral aneurysm, which leads to "leaving a large part of patients waiting for two weeks" before treating the aneurysm; This implies devastating consequences in the event of rebleeding or vasospasm since it is not possible to perform optimal management of these complications due to the lack of exclusion of the aneurysm.

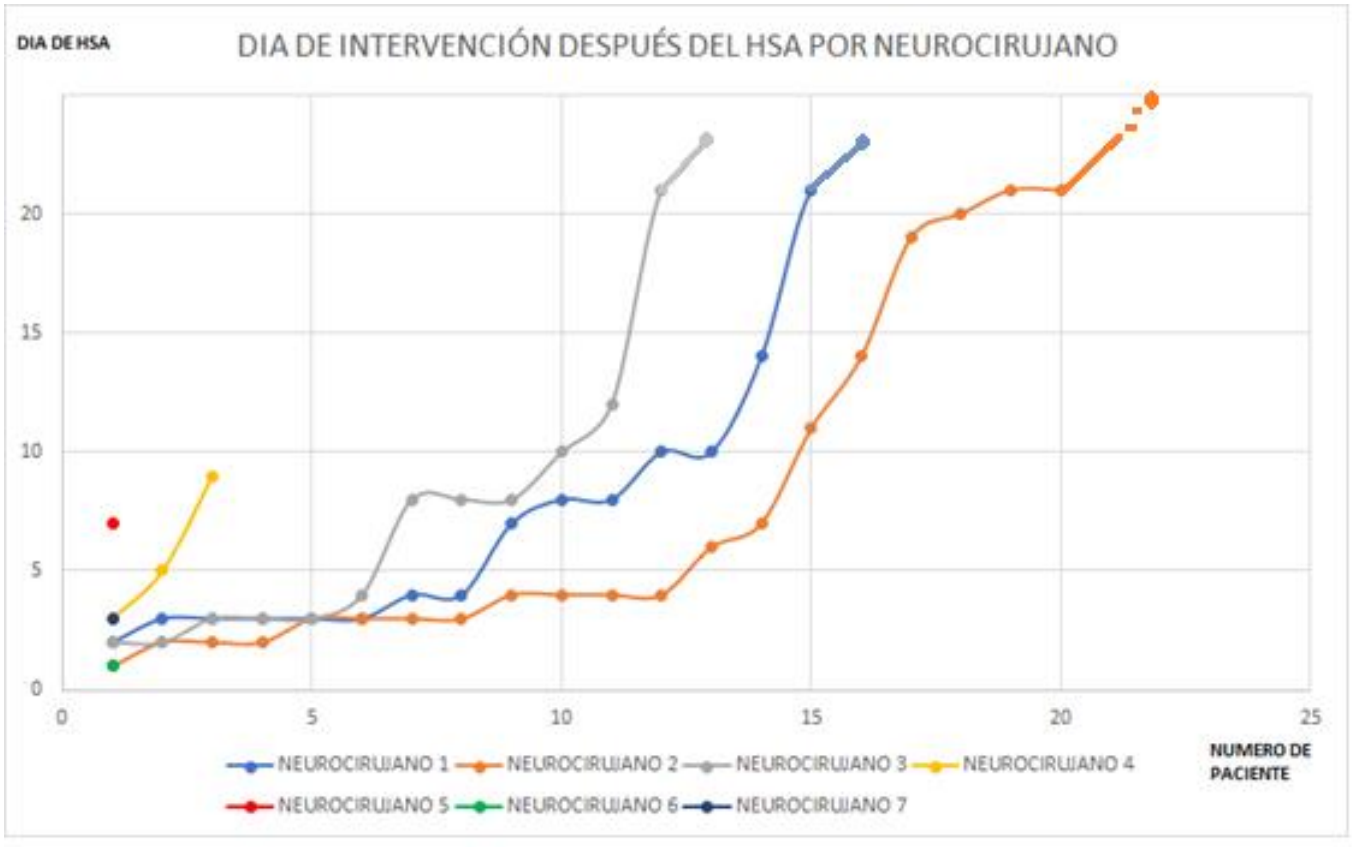

Fig 6. Distribution of brain aneurysms according to the day of treatment after the SAH episode and according to the Neurosurgeon in charge.

This delay is corroborated in the study by Dellaretti et al [14] in Brazil, where they report that several patients are not admitted to the hospital during the first three days after the hemorrhage, which generates discussion about the ideal time for surgery. Like Lamb et al[11] in London, it showed that in 133 of the 141 patients with SAH who received treatment, the average time was 109.8 + 11.3 hrs, and only a quarter was treated within 48 h later stroke. In this study, a significant delay in the treatment of 3/4 parts of patients with SAH willingly was identified and concluded that it could be due to the lack of availability of treatment the following day: all this having a health system superior to that of our environment.

Obviously, if the patient has a hospital admission and early diagnosis, the resolution "as soon as possible" of the aneurysm is the golden rule. It is unfortunate that many neurosurgeons put on trial that after 72 hours they delay management due to the little sustainable evidence. Furthermore, ultra-early management before 24 hours is associated with better clinical results compared with treatment after 24 hours, as shown by the results presented in an 11-year study of treatment of ruptured aneurysms in that 230 cases were resolved within 24 hours after subarachnoid hemorrhage and 229 after 24 hours. The benefit is more pronounced for embolization than for microsurgical clipping. [15]

To date, only a single randomized clinical trial published in 1989 has been carried out, which for obvious reasons is not possible to apply them at this time, in which the results of 211 patients were not conclusive, no differences were found between early surgery (within 3 days) and late surgery (more than 7 days after SAH), but the outcome was worse in the group of patients who were operated on in the intermediate phase (4 to 7 days after SAH).[16] These results have supported many guidelines and protocols.

Ross, et al[17] for 6 years prospectively studied patients admitted with a diagnosis of SAH and analyzed the influence of the time of surgery (early group day 1-3 post-SAH, intermediate group day 4-10 or late group day 11-21), found that 60.2% of the patients underwent early surgery, 32.4% entered the intermediate group and 7.5% in the late surgery group. They also highlight that late surgery was due to delays in diagnosis, transfer, and logistical factors, but not to the clinical decision. There were no significant differences in the GOS at 6 months between the groups of surgical time, therefore, the moment of the execution of the surgery did not significantly affect the results.

An observational study in the Netherlands showed that, of 352 operated patients, 232 were operated on in the early period; 36 in the intermediate period; 84 cases operated late. The unfavorable results or poor outcomes in the three groups were: 93 patients (34%) in the early group, 13 (36%) in those with intermediate surgery, and 37 (37%) in the late surgery group. As the group of patients operated between days 4 and 7 after SAH was small, the effect estimates have wide confidence intervals; therefore, the conclusions were not so clear. [18]

Negative results for the intermediate group were concluded from an intraoperative hypothermia trial for aneurysm surgery (IHAST), where early surgery, in patients of good grade within 48 hours post-stroke, was associated with better results than surgery performed in the interval of 3 to 6 days after bleeding.[19] This result was questioned due to possible biases given that the decision on the time of surgery must be weighed against the risk of rebleeding. [20]

Dorhout Mees et al[21] highlights that unfavorable results were greater when management was performed after day 10, they did not recommend postponing treatment in patients who are eligible to receive treatment between days 5 and 10 post-stroke, as did Dellaretti et al. [14].

The studies referring to the results according to the moment of exclusion of the ruptured aneurysm, in a large proportion, show great biases that reduce the quality of the conclusions as reported by systematic reviews on the subject. All of them find a single randomized controlled trial in which it is shown that the moment of exclusion of the ruptured aneurysm was not a critical factor in determining the result, it is even mentioned that most surgeons choose to operate within 3- or 4-days post-stroke in patients of good clinical grade. Although some subgroup analyzes indicated a trend with more benefit for early treatment. [22, 23, 24].

Among the complications of SAH we have hydrocephalus, epileptic seizures, rebleeding, vasospasm, and infections. Compared with other decades, the faster diagnosis, better preoperative planning, improvement of the execution of the surgery, and advances in microsurgical and endovascular technology, as well as the development in neuroanesthesiology and neurointensive care has globally reduced morbidity and mortality.[1, 8].

Regarding mortality, Roca et al[4] determined that the mortality rate was 8.72%, with sepsis being the first cause of death in 17 patients (2.79%), followed by an arterial spasm in 10 patients (1.64%), rebleeding in 6 patients (0.98%). Other studies in South America report mortality of 15.1% [14] vs 17.8% in our study. According to Dorhout Mees et al,[21] the percentage of late cerebral ischemia was comparable in all groups at the time of treatment. Marieke J.H. Wermer et al [25] pointed out that a new episode of SAH had occurred in 18 patients (2.4%) of the 752 patients during the follow-up period in patients undergoing clipping for ruptured aneurysms.

Mason A. Brown et al [26] evaluated risk factors for recurrence in clipping patients. In their study, 59 residual aneurysms that remained after initial clipping, 8 (13.6%) demonstrated growth. It was also found that de novo aneurysm formation occurred in 8 patients (0.97%), all of whom had multiple aneurysms. Ramazan Jabbarli et al [27] evaluated the remanence after important clipping, found that the location (ACA> ICA> PC> MCA) and the largest size (> 12 mm) of a brain aneurysm were the most risk factors. All these studies conclude on the need to follow up with vascular images and plan the treatment of recurrence of cerebral aneurysms.

CONCLUSIONS

In our study it was found that more women than men suffer from this disease, the treatment of aneurysms was mainly by microsurgery, the aneurysms of the AComA, AComP, and middle cerebral (MCA) had a similar proportion and, in more than 50% the treatment, it was done in the first 4 days. More State Support Required to Increase endovascular therapy and obtain more promising results.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Authors Contributions

Conception and design: All the authors. *Drafting the article:* Rojas G. Critically revising the article: Rojas G. *Reviewed submitted version of manuscript:* Rojas G. *Approved the final version of the manuscript on behalf of all authors:* Rojas G.

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