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Original Article

Small Aneurysms Should Be Clipped?

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Abstract

Background: Cerebral aneurysm prevalence may vary from 0.4% to 10%. The decision to treat or not incidental aneurysms remains controversial, especially when the lesions are small (<5 mm). Many recent publications are demonstrating that these lesions often bleed. **Methods:** We reviewed admitted patients with angiographic studies submitted to intracranial aneurysm surgical treatment from April 2012 to July 2013 in the Neurosurgery Department of São Paulo Medical School University (15 months), to define the rate and risk of bleeding. In addition, we proceeded literature review with collected 357 papers (past 5 years) which were selected 50 that were focused on our research. Clinical patients' status at the time of discharge was evaluated with the modified Rankin scale. **Results:** A series of 118 cases of surgically clipped aneurysms was analyzed: 73.7% woman; Ruptured (61 cases, 51%); middle cerebral artery (51 cases, 43%) was the more common aneurysm. Small size (<5 mm) was 25 cases (21%); that 2 died (16%), 3 (25%) with severe disability,restricted to bed and dependent on nursing care; blood pressure was the main risk factors (56%); and an aneurysm <2 mm (100%) was ruptured. **Conclusion:** The number of small aneurysms in our series was significant (25 cases, 21%), and its rate of bleeding was high (25 cases, 48%), resulting in death and disability in a significant number of cases. Our tendency is for surgical treatment when it is associated with risk factors.

Keywords: *Aneurysm clipped, cerebral hemorrhage, intracranial aneurysm, small cerebral aneurysm, subarachnoid hemorrhage*

Introduction

Cerebral aneurysm prevalence may vary from 0.4% to 10%.[1,2] The incidence of subarachnoid hemorrhage (SAH) ranges from 6 to 21.6 per 100,000 persons per year, depending on the study population and methodology.[2-4] A more significant number of related cases have been identified with the development and availability of more sophisticated brain diagnostic methods. Despite this, the management of these aneurysm groups is still controversial. There is no consensus about the best treatment for an incidental aneurysm, especially when it is small.

According to the International Study of Unruptured Intracranial Aneurysms, the risk of rupture of anterior circulation aneurysms smaller than 7 mm is only 0.1% per year. However, experienced neurosurgeons and interventional neuroradiologists reported that, in clinical practice, small aneurysms are ruptured in most of the time,[5-8] and the SAH after small aneurysm rupture is often more significant, compared to massive aneurysm rupture.[8,9]

In this paper, the authors present one series analysis of small ruptured and intact aneurysms, treated surgically in the past 15 months, emphasizing clinical and surgical aspects of aneurysms smaller than 5 mm.

Methods

We reviewed the electronic files and admitted patients with angiographic studies submitted to intracranial aneurysm surgical treatment from April 2012 to July 2013 in the Neurosurgery Department of São Paulo Medical School University. This study was approval in our Institutional Board Review.

Patients were characterized by age and gender. The aneurysm localization, the occurrence of rupture, and the dimensions of the lesion were also observed, focusing in smaller aneurysms (<5 mm) and their powerful bleeding.

Aneurysms were arbitrarily classified according to its largest diameter: small (<5 mm), medium (5–10 mm), large (11–25 mm), and giant (>25 mm).[3] In cases with more than one aneurysm, only the treatment with clipped lesion was considered.

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Clinical patients' status at the time of discharge was evaluated with the modified Rankin scale (mRS) to characterize the related morbidity.

A Medline literature search in the past 5 years was performed using the terms: "an intracranial aneurysm," "small cerebral aneurysm," "cerebral hemorrhage," "subarachnoid hemorrhage," and "an aneurysm clipped." We collected 357 papers from the literature search from which we selected 50 that were focused on our research. Articles published before the period of the search were eventually consulted given to its relevance to our discussion.

Results

During the 15-month period of the study, 125 patients underwent surgery for the treatment of cerebral aneurysms. Seven patients were due to incomplete information in the medical files.

Among the 118 patients considered for analysis, 31 (26.3%) were male and 87 (73.7%) female. The average age was 54.1 years, with a mean deviation of 8.07, ranging between 28 and 86 years. Ruptured aneurysms were prevalent in 61 patients (51.6%) and according to the Hunt-Hess scale were classified as Grade 1 (3 cases), Grade 2 (30 cases), Grade 3 (12 cases), Grade 4 (8 cases), and Grade 5 (6 cases).

The majority of the aneurysms were located in the middle cerebral artery (MCA; 51 cases, 43.2%; 25 ruptured and 26 unruptured), in the posterior communicating artery (23 cases, 19.4%; 13 ruptured and 10 unruptured), and in the anterior communicating artery (18 cases, 15.2%; 14 ruptured and 4 unruptured) showing in Table 1. In the small aneurysm group, the most common site of the lesion was MCA (15 cases, 60%; 5 ruptured and 10 unruptured) and Acoma (5 cases, 20%; all ruptured), representing in Table 1.

Among the patients with small unruptured aneurysms submitted to surgery, all (13/13) evolved with mild symptoms, remaining functional and independent for most daily activities (mRS-0, mRS-1, and mRS-2). Considering the 12 cases of aneurysms with <5 mm in diameter, two of these patients (16.6%) died – mRS-6. Three (25%) evolved with severe disability, restricted to bed, dependent on nursing care – mRS-5 [Table 2].

According to the size, the aneurysms were classified as small (25 cases, 21%), medium (61 cases, 52%), large (28 cases, 24%), and giant (4 cases, 3%). The bleeding rate for the aneurysms of small size was 48%, 57% for the medium size, 46% for the large, and 25% for the giant aneurysms.

Among the risk factors, high blood pressure was found in 14 patients (56%) with small aneurysms (6 in the ruptured group and 8 in the unruptured), dyslipidemia in 6 patients (24%), smoking in 3 (12%), and diabetes mellitus in 2 (8%). The mean age of the patients with small aneurysms was 50.32 ± 11.48 years.

Stratifying the patients with smaller than five aneurysms in three subgroups, namely: I (5–4.1 mm), 7 cases; II (4–2.1 mm), 15 cases; and III (≤2 mm), 3 cases, we observed a prevalence of rupture of 42.8% (3/7) in the first, 40% (6/15) in the second, and 100% (3/3) in the third subgroup, with a respective mean age of 51.1 ± 12.4, 51.8 ± 9.8, and 40.7 ± 17 years. In addition, the prevalence of hypertension in these groups was 71.4% (5/7), 53.3% (8/15), 13.3% (2/15), and 0%, respectively. There was a trend to increased morbidity in subgroup II and III [Table 3].

Table 1: Distribution by the topography of ruptured and unruptured aneurysms (all cases)

Topography	Ruptured	Unruptured
ACoA	14	4
ACA	1	1
MCA	25	26
Pericalosa	1	1
ICA	2	4
PCoA	13	10
OPHT	1	8
CH	0	0
HIPOPH	1	1
CPA	2	0
Basilar	1	1
Vertebral	0	1

ACoA – Anterior communicating artery; ACA – Anterior cerebral artery; MCA – Middle cerebral artery; PCoA – Posterior communicating artery; OPHT – Ophthalmic artery; HIPOPH – Superior hypophysial artery; CPA – Cerebral posterior artery; ICA – Internal carotid artery

Table 2: Distribution by the topography of ruptured and unruptured (aneurysms <5 mm)

Topography	Ruptured	Unruptured
ACoA	5	-
ACA	-	1
MCA	5	10
Pericalosa	1	-
ICA	-	-
PCoA	-	1
OPHT	1	-
CH	-	-
HIPOPH	-	1
CPA	-	-
Basilar	-	-
Vertebral	-	-

ACoA – Anterior communicating artery; ACA – Anterior cerebral artery; MCA – Middle cerebral artery; PCoA – Posterior communicating artery; OPHT – Ophthalmic artery; HIPOPH – Superior hypophysial artery; CPA – Cerebral posterior artery; ICA – Internal carotid artery

Discussion

SAH has a mortality rate of 40%–50%, and approximately 20% of the survivals present significant neurologic disability.[10,11] There is a consensus toward an early treatment of ruptured aneurysms. On the other hand, the recommendations regarding unruptured intracranial aneurysm management are still controversial.[12]

Aneurysm treatment complication should be considered in this context. Regarding embolization, the risks are aneurysm perforation, mechanical vasospasm, thromboembolism, and coil migration. Adverse events associated with surgery include infection, epidural or subdural hematomas, cranial nerve palsies, and ischemic infarction after clipping.[13-17] In a review of the subject, in 2013[18-20] found that an average rate of complications associated with clipping was 11%, ranging from 6.6% to 50%. Embolization analyses: the mean complication rate was 9%, between 4.1% and 28.6%.

A strong correlation between the aneurysm size aneurysm and the bled risk was pointed out by some authors[5,15,21-34] for whom the conservative treatment for aneurysms with <10 mm in diameter should be the recommendation. However, many published series demonstrated that small aneurysms (<10 mm) could bleed and should be operated.[3,6,8,9,13-19,25-27,35] This different point, they mean that the aneurysm diameter alone is not an accurate predictor for the risk of rupture.[20] Risk factors such as high blood pressure, young age, posterior circulation localization, and family history of SAH certainly contribute for aneurysm rupture.[22,29]

In our casuistic, aneurysms of all sizes presented SAH. The small number of patients with giant aneurysms (4 patients), the absence of a follow-up (retrospective analysis), selection bias, and the lack of control of some risk factors may be a possible mechanism. Among our cases, 48% (12/25) of aneurysms smaller than 5 mm ruptured, a bleeding tendency higher than the previously published.[3,5,10,15] This trend was confirmed when we stratified the group of small aneurysms in subgroups, noting that the prevalence of bleeding in small aneurysms remained high even in the subgroups below 2 mm, with a tendency to poor functional outcome after rupture of these smaller aneurysms.[36-44]

Table 3: Morbidity on discharge for patients with small aneurysms and in each subgroup of small aneurysms

Rankin	5-4.1 mm	4-2.1 mm	≤2 mm	Ruptured	Unruptured
0	-	1	1	2	3
1	2	1	-	3	9
2	-	-	-	-	1
3	1	-	-	1	-
4	-	-	4	1	-
5	-	2	-	3	-
6	-	1	6	2	-

Besides, some authors suggest that small aneurysms are associated with more extensive SAH.[45] Taylor *et al*.[46] reported that aneurysms <5 mm tend to a more significant association with a higher score on the Fisher scale, although there was no difference in the incidence of vasospasm or overall outcomes.

In a review of 100 cases of patients with SAH reported an inverse relationship between the size of an aneurysm and the volume of cisternal blood.[46] Besides, some authors concluded that there is a higher risk of rupture during embolization of aneurysms smaller than 5 mm.[8,47,48]

The reason for this fact presented in our casuistic is unclear, and prospective studies are necessary to explain this inverse relationship between the size and the volume of blood. For large aneurysms (>10 mm), the reported bled risk was significantly higher, reaching 33.5% at 5 years and 55.9% at 10 years.[27] In our retrospective analysis, the rate of bleeding for these aneurysms was 44% and 52% for aneurysms more significant than 10 and 5 mm, respectively.

Some of the risk factors of aneurismal rupture (high blood pressure, diabetes mellitus, dyslipidemia, and smoking) were presented in our patients with small aneurysms, but there was no significant difference when comparing ruptured and unruptured lesions.

An aspect that was not considered in our study is the tendency to the aneurysm growth, and its implications on the aneurysm bled risk. In 2013[38] following 319 small untreated aneurysms (<7 mm), with a mean follow-up of 29.2 ± 20.6 months, observed an increase in size in 42 of these, 5 of which over 7 mm. Another interesting point to discuss is the decrease in the size of an aneurysm after its rupture, as described by some authors.[38,39] Taking this into account, the aneurysms considered to be small after rupture, could have their previous rupture risk underestimated by only analysing the size. Thus, retrospective analysis, such as ours, may overestimate the rates of bleeding for small aneurysms.

This study suggests that small aneurysms represent a significant number of the ruptured lesions (20%, 2/61), leading us to postulate that the standard aneurysm treatment has to be considered.

Limitations of the study

This is a retrospective study, and all inherent method limitations do apply. The limited sample, losses of data registration, and its heterogeneity are potential flaws. We also did not have a sufficiently large number of cases; however, we can only affirm that we also have to consider surgery in a small aneurysm because they even can bleed and we deal with SAH.

Conclusion

Our data showed that aneurysms smaller than 5 mm (small) account for a significant portion of all aneurysms diagnosed,

incidentally or not, with a considerable rupture rate. There was a trend to increased morbidity in subgroup < 4 mm. Consequently, our tendency nowadays is for the surgical treatment of these lesions, especially when it is associated with risk factors, such as hypertension and smoking, which are present. Further prospective studies with longer follow-up and larger samples are needed to strengthen these conclusions.

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Conflicts of interest

There are no conflicts of interest.

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