

Determining the critical size of intracranial aneurysm predisposing to subarachnoid hemorrhage in the Saudi population

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ABSTRACT

Introduction: Aneurysmal subarachnoid hemorrhage (SAH) is a devastating event with a high rate of morbidity and mortality. With the improvement of diagnostic modalities and the adoption of different screening strategies, more aneurysms are being diagnosed prior to rupture. Based on large multi-center trials, size has become the most important determinant of treatment decisions. Unfortunately, these studies did not take into account the regional and racial variations, challenging the generalizability of their results.

Material and Methods: We conducted a retrospective analysis on a series of 192 patients harboring 213 aneurysms.

Results: The critical finding in our study is that the majority of patients presenting with SAH due to ruptured aneurysms are <10 mm in size.

Conclusion: Decision to treatment of a given unruptured intracranial aneurysm should be individually assessed and not taken from general international literature as this may mistakenly apply factors from one population to another.

Key words: Aneurysm size, intracranial aneurysms, ruptured aneurysms

Introduction

Aneurysmal subarachnoid hemorrhage (SAH) is a devastating event with significant mortality rate.^[1,2] Of the survivors of SAH, many suffer long-term neurological, cognitive and psychosocial sequelae, themselves and their families alike. Several factors have been identified to correlate with the risk of SAH including the size of the aneurysms, their location and their complex configuration.^[3-8] This is compounded by other clinical factors such as smoking and alcohol abuse.^[9] To add to the complexity of prediction of SAH, recent evidence suggests

some genetic influence increasing the risk of rupture of certain intracranial aneurysm (IA).^[10]

Nonetheless, size remains the most significant factor of these to stratify the risk of rupture of IAs.

Since their publication, the International Subarachnoid Aneurysm Trial (ISAT) and International Study of Unruptured Intracranial Aneurysms (ISUIA) trials serve as the cornerstone to decision-making regarding aneurysm treatment.^[11,12] Several reports and studies questioned the validity and generalizability of these studies.^[13-15] Among those is the major concern that these studies did not account for regional variability in different parts of the world.

We set out to study the incidence of aneurysm rupture based on the critical factor of size in a cohort of SAH patients in Saudi Arabia.

Materials and Methods

We retrospectively analyzed our series of ruptured IAs in 3 different centers in Saudi Arabia over a 12-year period (2000-2012). We stratified the incidence of hemorrhage across the established aneurysm size categories based on ISAT, which include, small (10 mm or less), medium (10-15 mm), large

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(15-25 mm), and giant (>25 mm). The size was measured on three-dimensional computed tomography angiography (CTA) and digital subtraction angiography. A cohort of unruptured aneurysms was included in the review, serving as internal control to exclude the possible size change at the time of rupture.^[16] Statistical analysis for the Z-score for proportions was performed by Prism 4 for Mac, (Graphpad software Inc., 2003).

Results

Our review included 192 patients in which 213 aneurysms were identified. Of these patients, 126 were females, and 66 were males with their age ranging from 42 to 81 years of age (mean of 61.5 years). Of these aneurysms, 183 were ruptured, and 30 were unruptured. Multiple aneurysms occurred in 2% of patients. For the location of the diagnosed aneurysm, 81 were on the posterior communicating artery (38%), 41 on the anterior communicating artery (19%), followed by 30 aneurysms located in the distal internal carotid segments (14%) [Table 1]. Other location included in descending order the middle cerebral artery, basilar artery, anterior choroidal artery and the posterior inferior cerebellar artery.

Of the 30-unruptured aneurysms, 13 were <10 mm. On the contrary, of the 183-ruptured aneurysms, 131 (71.5%) were <10 mm in diameter (Z-score 3.0649, $P = 0.00222$). Additional 41 aneurysms (22.4%) and 24 aneurysms (13.2%) were medium and large, respectively.

Analysis of the group of 131 small aneurysms presenting with rupture, 78 (59.6%) were between 8 and 10 mm, 35 (26.7%) were between 5 and 7 mm, and 18 (13.7%) were <4 mm in diameter.

Discussion

Aneurysmal SAH is a subtype of hemorrhagic stroke accounting for up of 7% of these events.^[17] It represents the presence of blood in the subarachnoid space, with the first description of its clinical syndrome done by Symonds in 1924. Spontaneous SAH presents in more the 90% of cases with sudden onset, severe headache of bursting nature. SAH can be diagnosed, depending on the timing of the evaluation by standard tools such as lumbar puncture, computed tomography (CT) scan, or magnetic resonance imaging scan and specifically the gradient-echo sequence, which is very sensitive to even small quantity of blood in the subarachnoid space that could be

missed by CT scan. Vascular imaging must be included in the workup in the form of CTA, magnetic resonance angiography or the gold standard, four-vessel cerebral angiography.

Subarachnoid hemorrhage is a major devastating event; with 15% mortality before reaching the hospital and of the survivors only 20-25% will be back to their normal baseline health and cognitive ability.^[18,19]

Although ISAT and ISUIA trials gave standardized risk for rupture aneurysms, the incidences of SAH in different regions in not uniform enough to adopt the concluded risk with certitude. For example, while the incidence of SAH in the United States is 6 in 100,000, it is 22.7 in 100,000 in Japan, 19.7 in Finland, and 4.2 in South and Central America.^[20] The world wide reported SAH incidence ranges from 2 to 25 per 100,000 persons per year, with most regional incidences between 7 and 13 per 100,000 persons per year.^[21] The differences in incidence amongst regions may be explained by racial/genetic differences, environmental factors or a combination of.^[20,22,23]

Size of aneurysms remains one of the most important criteria to decide on treating aneurysms whether endovascularly or microsurgically, the cornerstone of which is the available results of ISAT and ISUIA trial.^[11,12]

Several studies have challenged the conclusion of the aforementioned studies, depicting a smaller size at rupture in the Asian populations.^[13,24]

Our results represent largest series of ruptured aneurysms in Saudi Arabia that represent a pool of multicenter series in a vast country over a relatively long period. The majority of the diagnosed ruptured aneurysms were <10 mm, which one could have argued not to treat if they were unruptured. This carries a significant burden on the patient and the treating physician in regards to assessing a “realistic” risk as opposed to a theoretical and occasionally inapplicable statistics, because of the environmental and genetic differences amongst different world regions.

Decision to treatment of a given unruptured IA should be individually assessed and not taken from general international literature as this may mistakenly apply factors from one population to another. This would necessitate a regional study to assess the true incidence and identifying new risk factors of rupture for each particular region to better guide our patients. One such factor would be to study the parent vessel variation among nations and the relative size of the diagnosed aneurysm to the parent vessel and weather or not that influences the risk of rupture.

Conclusion

In the present study, the majority of ruptured aneurysms diagnosed in Saudis are <10 mm. This would require further

Table 1: Most common aneurysm locations

Location	Number (%)
Pcom	81 (38)
Acom	41 (19)
ICA	31 (14)

ICA – Internal carotid artery; Acom – Anterior communicating; Pcom – Posterior communicating

studies to identify risks of rupture, other than size to determine the threshold for treatment of unruptured aneurysms.

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