Original Paper

# Aneurysm Characteristics of Patients Presented with Sub-Arachnoid Haemorrhage in Combined Military Hospital Dhaka and Detected at Digital Substraction Angiography

Alam SZ[1], Islam MS[2], Alam MT[3]

## Abstract

***Introduction:*** Digital Substraction Angiography (DSA) is the gold standard for proper diagnosis and further evaluation of intra cranial aneurysm. Intracranial aneurysm rupture leading to Subarachnoid hemorrhage (SAH) may be associated with serious neurological sequelae or even mortality. According to international literature, only aneurysm >7 mm or aneurysm in the posterior circulation require treatment. Retrospective single center studies have however, disputed that the average size of ruptured aneurysms are <7 mm.

***Objective:*** To assess the aneurysm characteristics and demographics of patients who reported to CMH, Dhaka with SAH secondary to an aneurysm detected at Digital Subtraction Angiography (DSA).

***Materials and Methods:*** This retrospective study was conducted among the patients who presented with SAH more than 3 year period, from November 2013 to April 2017. All patients had undergone CT scan of brain in the department of Radiology & Imaging and DSA in the Cath Lab of Combined Military Hospital (CMH), Dhaka. Data about aneurysm characteristics, size and patient demographics were obtained from patients files.

***Results:*** A total of 74 patients underwent DSA and amongst them 32 patients had ruptured aneurysms. Ages ranging from 20 to 75 years (mean 45 years), little more male patients. The mean size of aneurysms was 5.8mm (range 1.2 mm to 20 mm) with 74.5% of aneurysms having size <7 mm. Most aneurysms were noted involving anterior circulation (72%) with the majority arising from the anterior communicating (ACom) artery (36.7%).

***Conclusion:*** An aneurysm is an abnormal dilatation of an artery. It can be found in almost any age and can rupture at size <7 mm. Those are commonly located in the anterior circulation. Findings of this study emphasize the importance of conducting the institutional reviews, to consider adapting the international treatment guidelines.

***Key-words:*** DSA (Digital Substraction Angiography), SAH (Sub-Arachnoid Hemorrhage), Aneurysm.

## Introduction

Digital Substraction Angiography (DSA) is gold standard for evaluation of intracranial aneurysm. Subarachnoid hemorrhage (SAH) secondary to aneurysmal rupture affects 10-15 per 100000 of the western population per year[1]. Aneurysmal SAH is a serious condition with mortality rates approaching to 50% and with 30% of survivors suffering moderate to severe neurological disability[2,3].

Literature originating mainly from the International Study of Unruptured Intracranial Aneurysms (ISUIA) advocated treatment of aneurysms >7mm or those in the posterior circulation, because of the lesser risk of rupture of those that are <7mm and in the anterior circulation[2,4]. Several single center reviews[5,6,7] have been published reporting that the average size of a ruptured intracranial aneurysm is significantly <7mm and that the annual rupture risk is between 0.5% and 2.7%.

Aneurysm location is another point of contention. Multiple studies pointed out that the majority of ruptured aneurysm involved the circle of Willis and anterior circulation[1,3,7]. This finding is contrary to ISUIA data Mc Nulty et al and Morita et al, all of which concluded that posterior circulation aneurysms are a greater risk of rupture[2,4,5].

Apart from the size and location, other risk factors for aneurysm rupture should be taken into consideration when deciding to treat or observe unruptured intracranial aneurysms. These include aneurysm configuration and and morphology, documented growth, female gender, younger age, current smoking history, hypertension and prior personal and family history of aneurysmal SAH[8,9].

1. **Col Syed Zoherul Alam**, MBBS, MCPS, FCPS (Radiology & imaging), Classified Specialist in Radiology & Imaging, CMH, Dhaka
2. **Dr Md Shafiqul Islam**, MBBS, MS, PhD, Associate Professor of Neurosurgery, Dhaka Medical College Hospital, Dhaka 3. **Brig Gen Md Taharul Alam**, MBBS, MCPS, FCPS (Radiology & Imaging), Advisor Specialist & Head, Dept of Radiology & Imaging, CMH, Dhaka.

## Materials and Methods

A retrospective, descriptive, observational study was performed on all patients who underwent cerebral DSA at Combined Military Hospital (CMH), Dhaka between 01 November 2013 and 15 April 2017. The equipments that are used for cerebral DSA examination during 3 and half year period were Siemens or GE healthcare single plane angiography unit.

The patients having SAH who underwent CT angiogram and subsequently causative aneurysm detected at DSA were included in this study (Figure-1). Patients with SAH detected on CT scan, but no subsequent DSA, were excluded from the study. Procedures performed for indications other than aneurysm-related SAH were also excluded from the study.

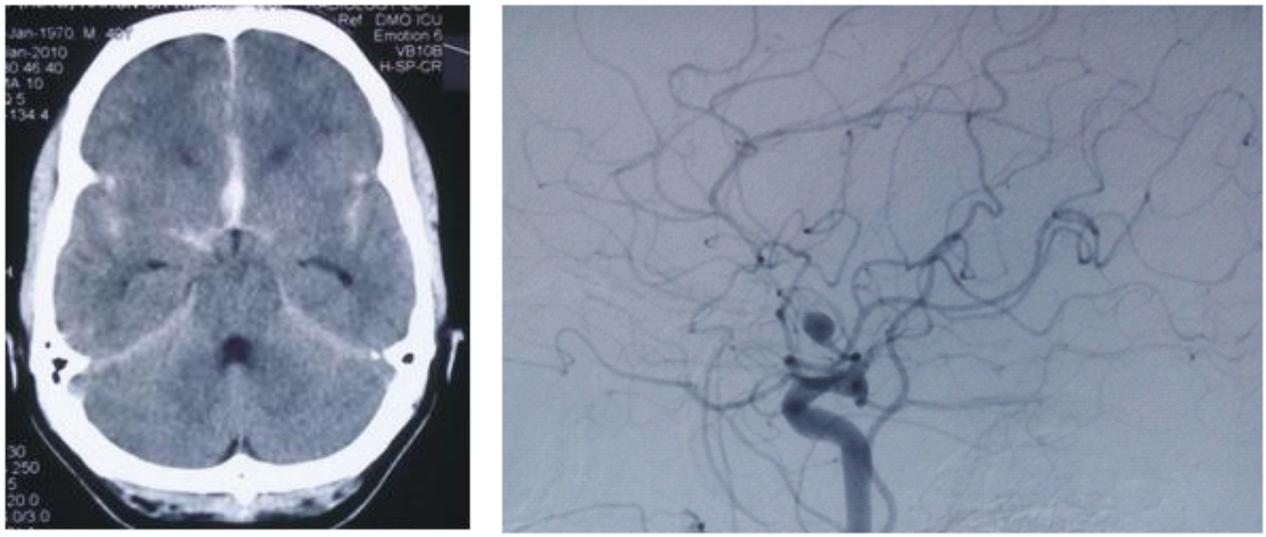


**Fig-1:** Non contrast CT Scan of Brain revealed SAH. DSA depicts ruptured Acom aneurysm

Patient's demographic information was gathered from patient files. Data regarding imaging for the aneurysms were obtained from console memory of CT scan department and Cath Lab of CMH, Dhaka which included hemorrhage, largest diameter, aneurysm neck to size ratio and aneurysm location.

Standard views were taken during DSA in Cath Lab. During the examination, the departmental protocol was used for measurement and characterization of aneurysms. The technique entailed three measurements with the aneurysm in profile that is largest axial diameter; largest longitudinal diameter and aneurysm neck diameter at its origin from the parent vessel were measure, as depicted in Figure-2.

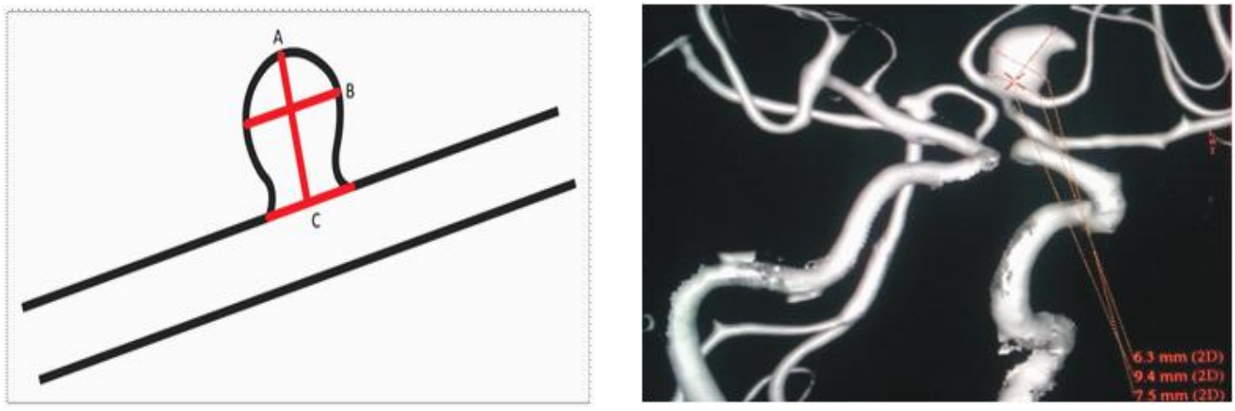


**Fig-2:** Measurement of aneurysms in profile: longitudinal diameter (a) transverse diameter, (b) aneurysm neck (c) at its origin from the parent vessel

The transverse diameter was the maximal axial aneurysm size and the longitudinal diameter was measured from the midpoint of the aneurysm neck to the aneurysm dome. Aneurysm size (largest transverse diameter) to neck ratio was divided into two groups, narrow (<50%) and wide (>50%).

Further characterization included identification of the vessel from which an aneurysm originated. These vessels were grouped as anterior circulation or posterior circulation. In cases multiple aneurysms, the one is closest proximity to the site of maximal SAH, irregular margins or regional vasospasm was selected.

Anterior circulation vessels included the intracranial internal carotid arteries and anterior and middle cerebral arteries, including distal branches. Posterior circulation vessels included posterior communicating arteries, posterior cerebral arteries, vertebral and basilar arteries including distal branches.

## Results

A total of 74 patients underwent cerebral DSA over more than 3 year period. Of these 32 had ruptured aneurysms. The remaining 42 patients were excluded from the study because the procedure was performed for indications other than aneurysm related SAH. Most of the patients were male (63.4%). Patient ages ranged from 20 to 75 years.

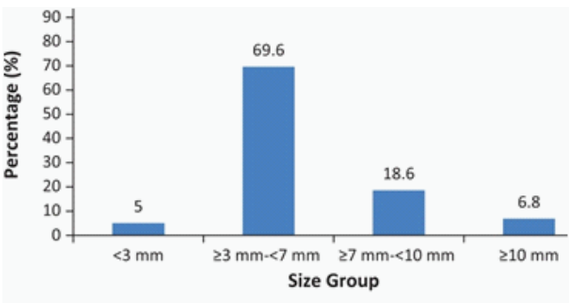


**Fig-3:** Percentage of aneurysms grouped by size (n=32)

Figure-4 shows the percentage of ruptured aneurysms grouped by size. The overall mean maximal aneurysm size was 5.2mm (range between 1.2mm and 20mm). In the anterior circulation, the mean size was 5.4mm, ranging between 1.2mm and 20mm. Aneurysms in the posterior circulation were slightly larger but not statistically different with a mean size of 6.4mm. The mean transverse size of aneurysms was 4.6mm (range between 1.1mm and 20mm) and the mean longitudinal size of aneurysms was 5.5mm (range between 1.1mm and 20mm). Slightly more than half of aneurysms (54%) had a wide neck whereas 46% had narrow neck. Most of the aneurysms were noted to involve the anterior circulation (72%) with the reminder in the posterior circulation (28%).

## Discussion

Characteristics about aneurysms are very little known in Bangladesh and South Asia but in Europe and North America it is widely studied. The ISUIA published in 2003 concluded that the annual risk of rupture in intracranial aneurysms <7mm in size and occurring in the anterior circulation was 0.1% in patients with no previous hemorrhage history[2].

Wiebers et al found that aneurysms >7mm have considerably increased risk of rupture and thus concluded that 7mm should be used as the cut off for considering treatment for these unruptured aneurysms, in the absence of other aneurysm characteristics indicating increased risk of rupture[2].

Risk factors for aneurysm formation include female gender, cigarette smoking, hypertension, family history of aneurysms (especially first degree relatives) and familial syndromes such as polycystic kidney disease. Risk factors for aneurysm growth include female gender, increased blood pressure, hemodynamic stress, inflammation and cigarette smoking in particular. Risk factors for aneurismal rupture include size and possibly location of aneurysm, morphology (i.e multilobulated, irregular dome), aneurysm growth, cigarette smoking, young patients at diagnosis, prior aneurysmal SAH, excessive alcohol consumption and hypertension.

Multiple single center studies reported an overall mean sac diameter of 6.5mm[13,14] and 5.7mm[15] for ruptured aneurysms. Similar population based studies reported that the majority of ruptured aneurysms are <5mm[1,7,13,16]. This retrospective analyses found an overall mean maximum sac diameter of 5.2mm with 75% of ruptured aneurysms <7mm. In total 93.2% ruptured aneurysm were <10mm in size.

Schneiders et al compared changes in aneurysm volume before and after rupture and found an increase in size[17]. This finding is supported by Kotaoka et al's findings of ruptured and unruptured aneurysms where no evidence of shrinkage of aneurysm after rupture was found[3,14,16]. Aneurysm neck to size (largest transverse diameter) ratio is used in different institutions to determine the method of

treatment, those with narrow necks (<50%) undergo endovascular coiling and the reminder with wide necks (>50%) are treated by surgical clipping[17].

## Conclusion

Mortality rates due to sub arachnoid hemorrhage (SAH) appear to be decreasing over the time in western populations. Improvements in the rates of smoking, treatment of hypertension and management of SAH are plausible but unproven reasons for the reduction of mortality. Improved diagnostic accuracy over time, including exclusion of SAH mimics as well as therapeutic advances may play a role.

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