The Egyptian Journal of Hospital Medicine (October 2017) Vol. 69 (7), Page 2860-2864

# Neurosurgery for Cerebral Aneurysm

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## ABSTRACT

**Background:** Management of small aneurysms regularly poses a therapeutic problem and surgical treatment or coiling can be considered as therapeutic choices. In the current study, we reviewed our series of ruptured small cerebral aneurysm preserved surgically.

**Materials and Methods:**A total of 53 consecutive patients with ruptured small aneurysm were surgically treated between November 2014 and November 2016. Data were retrospectively collected. Procedure-related death and complications were systematically reviewed. Clinical outcomes were evaluated utilizing the Modified Ranking Scale. Neuroradiological follow-up was performed to evaluate aneurysmal occlusion and recanalization rate.

**Results:** The mean aneurysm size was 2 mm ± 0.7 mm. All the patients were operated and the aneurysm clipped. Clinical outcomes were as expected on the basis of the presenting Hunt and Hess grade. Generally, major and minor neurological deficit related to clipping were 5% and 3%, respectively. At the time of discharge, 85% of the patients presented with a favorable outcome, while 15% had poor clinical outcome. Aneurysm occlusion was achieved in all the cases. Neither recanalization nor re-aneurysmal rupture was observed in the clinical follow-up.

**Conclusion:** Aneurysms, 3 mm in diameter or smaller, represent a therapeutic challenge. Given the proven role of microsurgery in small aneurysms and the perceived challenges with endovascular therapy, surgical clipping still can be considered an effective treatment modality in this setting.

**Keywords:** Neuroradiology, Intracranial Aneurysm, Treatment Outcome, Retrospective Studies.

## INTRODUCTION

Subarachnoid hemorrhage (SAH) from rupture of an intracranial aneurysm is a distressing occasion. Data from population-based studies suggest that the incidence rates of cerebral aneurysm vary considerably from 6 to 16/100,000 [1, 2]. The overall mortality rates from 32% to 67% with 10–20% of patients with long-term dependence due to brain injury [3, 4]. Twelve percent of patients influenced by aneurismal subarachnoid hemorrhage die before therapeutic treatment and 25% die within 24 hours. A further 40–60% mortality rate happens within a month [5]. Result relies upon a heap of interrelated components, including the seriousness of the underlying occasion, re-bleeding, perioperative therapeutic treatment, and the planning and specialized achievement of aneurysm treatment. Treatment of burst cerebral aneurysm is the essential worry in all patients after subarachnoid hemorrhage. Up to now, surgical treatment is identified with a death rate of 2% and around 10% morbidity rate [6 - 8]. Main complications identified with surgery are draining event some time recently, after, or amid surgical cutting because of an intra-operative rupture (IOR), cerebral ischemia prompted by brief clasp situating or of parent vessel impediment, and cerebrum harm identified with intraoperative retractors use [9-11].

Little aneurysms represent 6% of all ruptured intracranial aneurysms [12] and their administration stays stimulating. The International Study of Unruptured Intracranial Aneurysms (ISUIA)[13] presumed that asymptomatic aneurysms <7 mm in width in the foremost course have a negligible provability of break. Most as of late, the Unruptured Cerebral Aneurysm Study (UCAS) generated outcomes like the ISUIA [14]. On the other hand, a few investigators have repudiated these examinations, revealing a higher level of little aneurysms among their case arrangement of ruptured intracranial aneurysms [15-17]. This demonstrates an inconsistency between the ISUIA and UCAS information and the extent of cracked aneurysms found in routine clinical practice. In spite of the fact that the International Subarachnoid Aneurysm Trial (ISAT) demonstrated a result advantage with endovascular curling contrasted with surgical



Received:21 /09/2017
Accepted: 30 /09/2017
DOI: 10.12816/0042579

clipping [18], management of little aneurysms have not been viewed as given the specialized issue for the endovascular approach. Coiling of little aneurysms is related with a generally high danger of iatrogenic aneurysm crack or movement of the loop into the parent vessel [19]. The motivations behind our examination were to assess wellbeing of section system for little burst aneurysms as far as grimness, mortality and proficiency of aneurysm impediment, repeat and rebleeding at short-and long haul development.

## METHODS

A retrospective chart review was completed for all patients who had surgical management of an aneurysm ≤3 mm in diameter between 2014 and 2016. Amid a cohort of 191 surgically treated aneurysms, a total of 40 consecutive patients were registered. Blister aneurysms were not considered in this series as they vary both morphologically and histologically from saccular aneurysms and probably signify a distinct pathophysiology. Medical charts, angiographic studies, magnetic resonance imaging (MRI) scans, computed tomographic (CT) and CT angiography (CTA) scans were cautiously reviewed. Patients' age, gender, Hunt and Hess grades, and aneurysm locations were documented. All diagnoses were completed on imaging (CTA, MRI angiography and/or digital angiography). Morbidity and mortality allied to clipping were defined as intra-procedural and/or postoperative ischemic or bleeding trials. Stroke was defined as a new neurological shortage on clinical inspection throughout 48 h subsequent surgery with an imagining of CT hypodensity and/or high signal MRI intensity on seeming diffusion coefficient arrangements. Patients presenting with neurological shortages without modified signal or density in neuroradiological exams were considered influenced by cerebral vasospasm. Bleeding complications were defined as a new postoperative hematoma in the aneurysmal vascular area or an increasing volume of more than one-third of an intra-parenchymal hematoma in the next 12 hours after surgery. An independent neuroradiologist and neurosurgeon, blinded to the study, revised both clinical and radiological records to assess causes for ischemic or bleeding events and their association with surgery.

Surgical treatment was attempted after the determination of cerebral aneurysm, and no later than 24 hours following bleeding. Distinctive surgical methodologies were utilized by aneurysm area. Following the intraoperative distinguishing proof of the aneurysm, transitory clips were routinely utilized as a part of the considerable number of cases to anticipate aneurysm break. In similar manner, aneurysm was confined and cut utilizing miniclip. Lamina terminalis was fenestrated in every one of the cases for hydrocephalus prevention [20]. At the end of the system, patients were observed in the Neuro Intensive Care Unit and nimodipine was managed for cerebral vasospasm. Patients came back to neurosurgical unit and released to home or restoration office as indicated by their functional inabilities.

**The study was done according to the ethical board of King Abdulaziz university.**

## RESULTS

Amid November 2014 and November 2016, amid a cohort of 191 surgically treated aneurysms, 40 consecutive patients underwent surgical treatment for ruptured small cerebral aneurysm. The mean age of patients was 49.7 years (range, 24–76 years). Seventy percent of patients were women (n = 28) and 30% were men (n = 12). The mean Hunt and Hess grade at the time of admission was 2 (range, 2–4) and the mean Fisher score was 2 (range, 1–4). The mean aneurysm size was 2 mm ± 0.7 mm. Demographics characteristics and aneurysm location are shown in Table 1. Aneurysm clipping was successfully achieved in all the patients.

**Table 1:** Demographics characteristics and aneurysm location

| Demographics characteristics | Column1 |
|---|---|
| **Total patients (n)** | 40 |
| **Mean age (year, mean±SD)** | 49.7±9.8 |
| **Male** | 12 |
| **Female** | 28 |
| **Aneurysm size (mean±SD)** | 2±0.7 |
| **Hunt and Hess (mean±SD)** | 2±1.1 |
| **Fisher (mean±SD)** | 2±1.0 |
| **Aneurysm location** | |
| **Anterior communicating** | 14 |
| **Carotid terminus** | 9 |
| **Posterior communicating** | 8 |
| **Anterior choroidal** | 5 |
| **Pericallosal** | 2 |
| **Posterior inferior cerebellar artery** | 1 |
| **Basilar** | 1 |
| **Total** | 40 |

Hemorrhage associated with surgery was observed in 13% of the cases and ischemia in 15%. No mortality related to clipping was perceived. Generally, major and minor neurological deficit related to clipping were 5% and 3%, respectively.

IOR rate was 15% in the whole cohort. In one case (2.5%), a surgical site infection was detected and entirely solved by targeted antibiotic treatment. In another case (2.5%), postoperative seizure was treated by a combination of antiepileptic drugs. Cerebral vasospasm was detected in 33% of the patients. Hydrocephalus developed in 15% of the patients and was treated by ventriculoperitoneal shunt placement. At the time of discharge, 85% of the patients achieved a favorable outcome (moderate, mild, or no disability). Only 6 patients (15%) had poor clinical outcome. Generally, Hunt and Hess Grades III–V were related with poor clinical outcome [Table 2]. Throughout the follow-up, only 26 patients amid 40 patients (65%) received a CTA control to evaluate recanalization rate. Complete aneurysm occlusion was perceived in all the patients at an average neuroradiological follow-up spanning 36 months. Neither recanalization nor rebleeding was stated for patients who have been controlled by a second CTA.

**Table 2:** Result associated to surgery

| | N | % |
|---|---|---|
| **Total aneurysms** | 40,0 | 100% |
| **Favorable outcome** | 34,0 | 85% |
| **Poor clinical outcome** | 6,0 | 15% |
| **Ischemia related to surgery** | 6,0 | 15% |
| **Hemorrhage related to surgery** | 5,0 | 13% |
| **Major neurological deficit** | 2,0 | 5% |
| **Minor neurological deficit** | 1,0 | 3% |
| **Cerebral vasospasm** | 13,0 | 33% |
| **Hydrocephalus** | 6,0 | 15% |

## DISCUSSION

Small aneurysms with 3 mm or less in distance across are uncommon lesions indicating a real challenge for diagnosis and treatment. Due to their small size, a broad-based neck, and fragile-thin wall, these aneurysms are tough to manage. The ideal management of small aneurysms stays disputable. In the ISUIA, the perioperative morbidity and mortality for patients who experienced either clipping or coiling of their unruptured intracranial aneurysm was around 10% [21,22].The regular history of these aneurysms stays irregular with the possibility to increment in size, change in configuration, and rebleeding rate that appears to be undefined compared to larger aneurysms [12]. It has been accounted for that patients with cracked intracranial aneurysms <5 mm are related with a higher rate of introduction with poor Hunt and Hess grades than burst intracranial aneurysms bigger than 5 mm. Moreover, in the clinical setting, roughly, half of the cracked intracranial aneurysms <5 mm and 65% of burst intracranial aneurysms bigger than 5 mm are clinically given a decent Hunt and Hess SAH grade [23]. Endovascular administration is in principle challenging as a result of the small size of the aneurysms. Coiling has been related with an expanded danger of intraprocedural rupture [19,24]. It has been stated as successful management by utilizing protected stent grafts or multiple porous stents [25]. More newly, flow-diverting stents have been suggested as a management modality for these aneurysms [26]. Though, similarly with these procedure, drawbacks have been described to cause stroke as the after effect of occlusion of jailed perforating vessels.

Since patients with little aneurysms were excluded from ISAT, data about these aneurysms originates from unpowered examinations. The BRAT, another driving examination, detailed poor result at 1 year in 33.7% of patients treated with open surgery versus 23.2% of the individuals who experienced endovascular treatment [27]. Nonetheless, additionally in this investigation, the agents did not determine what number of little aneurysms were enlisted, how they were dealt with, or what the result was in such patients. The examination from Chalouhi et al. [28] was the first to compare surgical section and endovascular treatment in a successive arrangement of patients harboring little ruptured cerebral aneurysms. They found that endovascular treatment had a fundamentally lower complexity rate than open surgery, with a low rate of intraprocedural rupture. Ideal results were not measurably extraordinary between the endovascular and surgical gatherings. Endovascular techniques bombed up to 10% of all cases in this review, with a noteworthy extent of patients' traverse to surgical cut-out. The rate of repeat was 18.2% and retreatment was 12.7%. Surgical cut-out of little burst aneurysm was related with a 23.3%

entanglement rate and permanent morbidity and mortality rates constrained to 8.3% and 0%, respectively.

In our investigation, aneurysm clipping was effectively accomplished in every one of the patients. Major and minor neurological deficiency identified with section were 5% and 3%, individually. No mortality identified with cut-out was watched. Ischemia identified with surgery was seen in 15% of the cases and hemorrhage in 13%. Generally, IOR rate was 15% in the entire cohort. Cerebral vasospasm was observed in 33% of the cases. Hydrocephalus developed in 15% of the patients and was treated by ventriculoperitoneal shunt placement. At the time of discharge, 85% of the patients achieved a favorable outcome (moderate, mild, or no disability). Only 6 patients (15%) had poor clinical outcome. Generally, Hunt and Hess Grades III–V were associated with poor clinical result. Amid the follow-up, complete aneurysm impediment was seen in every one of the patients at a normal neuroradiological follow-up of 36 months. Neither recanalization nor rebleeding was accounted for patients who have been controlled by a moment CTA. In one case, a surgical site contamination was watched and totally tackled by focused anti-microbial treatment. For another situation, postoperative seizure was dealt with by a blend of antiepileptic drugs.

In our study, we regularly used temporary clips for safe aneurysm dissection. Small aneurysms have a fragile, thin wall and dissection might be monitored by aneurysm rupture leaving a hole into the artery wall. Temporary clips application decreases the danger of aneurysm rupture and gives an ideal opinion for miniclip application on aneurysm.

Our findings recommend that surgical clipping can still be considered an active treatment modality for small-ruptured aneurysm. Though, this study is based on a retrospective analysis from a single hospital experience without independent outcome assignment and do not compare surgical versus endovascular treatment. Additionally, a significant number of clipped aneurysms have not been controlled by second CTA. These limitations, though, do not undermine from the significance of the outcomes attained. Aneurysm clipping was positively attained in all the patients without mortality and low morbidity rate connected to surgical treatment. At the time of discharge, nearly all the patients managed a favorable result.

## CONCLUSION

Small aneurysms signify a true challenge for diagnosis and treatment. Our findings aim the effectiveness of surgical clipping even though emerging information points out a growing endovascular solution. Large randomized controlled trial to compare the two treatment modalities can explain most of the significant issues. Meanwhile, surgical treatment of small aneurysms residues safely and effectively.

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