

# Surgical Outcome of Multiple Intracranial Aneurysms

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Multiple intracranial aneurysms are relatively uncommon among patients of intracranial aneurysms. The aim of management has traditionally been the same i.e. clipping of all the aneurysms to eliminate the risk of rebleed. This study was conducted to determine the outcome of patients of multiple intracranial aneurysms at Mayo Hospital Lahore, Pakistan. The study period was from September 1999 to January 2002. Four patients were diagnosed having multiple intracranial aneurysms. Age range was 40 to 65 years and 2 (50%) patients were female. Patients were assessed according to Hunt & Hess grade. Clinical presentation was favoring the site of ruptured aneurysm in one patient and CT brain was suggestive of site in two patients. All patients had 2 aneurysms. In three (75%) cases, aneurysm were unilateral and in one (25%) case, bilateral. Half (50%) patients had clipping of aneurysms through single craniotomy and half (50%) had bilateral craniotomies. Outcome was graded according to Glasgow Outcome Scale. Three (75%) patients had good outcome and one (25%) patient died after clipping of aneurysms due to vasospasm, infarction and metabolic disturbance.

**Key words:** Multiple intracranial aneurysms, subarachnoid hemorrhage, surgical outcome.

Multiple aneurysms are uncommon among patients of intracranial aneurysms. In the Co-operative Society Study, 19% of the patients had multiple aneurysms<sup>1</sup>. Chances of finding posterior circulation aneurysm is 3-5% in the presence of anterior circulation aneurysm<sup>2</sup>. These are more common in female with ratio of 5:1 in patients with two aneurysms and 11:1 in three intracranial aneurysms<sup>3,15</sup>.

Increasing risk of rupture with age is same as for single aneurysms. Incidence of multiple intracranial aneurysms is high among patients of hypertension, arteriovenous malformation, sickle cell disease, congenital and connective tissue disorder e.g. Ehlor Danlos syndrome, Marfan's syndrome, Moyamoya disease, fibromuscular dysplasia, coarctation of aorta, adult polycystic disease of kidney and tuberous sclerosis<sup>4,5,6,7,8,9,10,11,12,13</sup>. Multiple intracranial aneurysms have been reported to have association with branchio-oto-dysplasia<sup>14,15</sup>.

## Materials and methods:

This study was conducted to determine the outcome of patients of multiple intracranial aneurysms from September 1999 to February 2002 in Department of Neurosurgery, Mayo Hospital Lahore, Pakistan.

All the patients who presented with history and clinical examination suggestive of subarachnoid hemorrhage had CT brain without contrast. Patients with confirmed subarachnoid hemorrhage in Hunt and Hess Grade I, II and III had four vessels cerebral angiography. No patient with Hunt and Hess grade IV or V had angiography till they improved to Grade I, II or III. Only patients with more than one intracranial aneurysm were included in the study. All patients had clipping of aneurysms.

## Results:

Four patients were diagnosed having multiple intracranial aneurysms of which two were female. Age range was 40 to 65 years. No patient had history of warning headache.

Two patients (50%) had Hunt and Hess grade-II at the time of presentation while one each (25%) had grade I & III respectively. Clinical presentation was favoring site of ruptured aneurysm in one patient and CT brain was suggestive of site of rupture in two patients.

All patients had two aneurysms, 75% (3/4) unilateral and 25% (1/4) bilateral. Fifty percent (2/4) cases had anterior communicating artery (ACom) aneurysm associated with ipsilateral middle cerebral (MCA) aneurysm. ACom associated with ipsilateral posterior communicating (P Com) aneurysm were present in 25%(1/4) patient. Bilateral MCA aneurysms were found in 25% (1/4) cases.

All patients had craniotomy and clipping of aneurysms. Unilateral craniotomy was done in 50%(2/4) patients and 50%(2/4) through bilateral craniotomies.

**Outcome:** Three (75%) patients had good outcome and one (25%) patient died after clipping of aneurysms due to ischemia, infarction and metabolic complications. One patient (25%) had postoperative hydrocephalus for which he had ventriculoperitoneal shunt four weeks after clipping of aneurysms.



Cerebral angiogram showing anterior communicating and middle cerebral artery aneurysms.



**Discussion:**

Outcome of patients of subarachnoid hemorrhage having multiple intracranial aneurysms is attributed to ruptured aneurysm. It is always the site of rebleed affecting mortality and morbidity. The same should be the strategy of management i.e. clipping ruptured aneurysm first, to prevent rebleed. Diagnosis of ruptured aneurysm in a patient of multiple intracranial aneurysms is an important pre-operative assessment. Nehl's et al reported 97.5% accuracy using radiological and clinical criteria<sup>16</sup>. It includes findings of neurological examination, CT brain, cerebral angiography, EEG and of MRI brain. These were used to localize which one of the multiple aneurysms has ruptured. If ruptured aneurysm is still controversial, the aneurysm with highest probability was considered as ruptured.

The location of the most prominent portion of SAH is important because it suggests which of the multiple aneurysms ruptured<sup>17</sup>.

It is especially true for A Com aneurysm. Septum pellucidum and adjacent frontal lobe ICH is pathognomonic for it. Interhemispheric ICH is also suggestive of ruptured A Com aneurysm<sup>17</sup>. Sylvian fissure SAH and temporal lobe ICH is suggestive of ruptured MCA aneurysm. Carotid bifurcation aneurysm may bleed in the region of basal ganglia, medial fronto-temporal lobe and subarachnoid space close to it<sup>17</sup>. Intraventricular hemorrhage in temporal horns is almost always associated with temporal lobe intracerebral hematoma because most hemorrhages rupture through temporal lobe into the ventricle. Ruptured basilar tip aneurysm may show SAH in interpeduncular cistern and rupture of posterior inferior cerebellar artery aneurysm may show SAH into cisterna magna and 4th ventricle<sup>17</sup>.

Findings on angiography along with CT brain make the most reliable criteria to diagnose which one of the multiple intracranial aneurysms ruptured. Four vessels digital subtraction angiography of brain is the investigation of choice.

The most reliable signs include

- focal vasospasm
- focal mass effect due to hematoma and changes in the shape of aneurysm on serial angiogram.
- Extravasation of dye also called smoking gun sign is the most reliable but is uncommon.
- Irregularity of aneurysm is considered more reliable if size and shape of aneurysms are compared.

If the site of aneurysm rupture remains undetermined, clinical and EEG findings may be helpful. Clinical criteria are helpful in only 30% patients and accuracy can be increased to 62% if combined with EEG findings<sup>18</sup>.

If the site of rupture remains uncertain, MRI brain or cerebral angiogram should be done. If controversy still exists, the aneurysm with the highest probability is considered as ruptured.

After having a definitive diagnosis which of the multiple intracranial aneurysms ruptured, Principles of surgical management are same as for single aneurysm except following:

1. To decide craniotomy to clip all aneurysms through one approach.
2. When more than one craniotomy is required, ruptured aneurysm is clipped first.

The approach is considered better through which all the aneurysms can be clipped. If it is not possible to clip all the aneurysms, ruptured aneurysm is given priority.

Mortality and morbidity of patients of multiple intracranial aneurysms are attributed to ruptured aneurysm. Risk of rupture is same as for single aneurysm and site is always the same as that of previous one<sup>19</sup>.

Advantages of single stage approach are that patient can be saved from second operation and all aneurysms can be clipped decreasing the risk of bleed from unruptured one and triple H (hydration, hypervolemia, hypertension) therapy can be started in case of vasospasm because there is no risk of rebleed.

Disadvantages are that clipping the ruptured aneurysm first can obscure the view of unruptured aneurysms making their clipping difficult. Multiple anterior circulation aneurysms can be approached through single craniotomy<sup>20</sup>.

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