Mirror Aneurysms Among Multiple Aneurysms: Lesser of the Two Evils

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■ BACKGROUND: **To highlight the management nuances in addressing mirror aneurysms (MirAns) in a subset of multiple aneurysms.**

■ METHODS: **A retrospective study was carried out and all multiple intracranial aneurysms ($n = 70$) over 9 years were identified. Exclusion criteria were associated arteriovenous malformations, moyamoya disease, and either traumatic or mycotic aneurysms or those managed by endovascular approach alone. Patients were grouped as MirAn and non-mirror aneurysms (nMirAns). Outcome was assessed by Glasgow Outcome Score at 1 month. The Pearson χ^2 test or Fisher exact test were used to establish association.**

■ RESULTS: **MirAns ($n = 17$) accounted for 2.1% of all intracranial aneurysms and 24.3% of multiple aneurysms. Female predilection was eminent in the MirAn group (3.25:1) compared with the nMirAn group (2.5:1). The middle cerebral artery ($n = 6$) followed by the internal carotid artery–posterior communicating artery ($n = 5$) were the most common sites of the MirAns. There was no significant difference between the 2 groups for hypertension or age (MirAn, 52 years [± 11.231]; hypertension, 52.9%; nMirAn, 48.58 years [± 12.97]; hypertension, 54.7%). There was a definite trend towards less intraoperative rupture (MirAn, 4/17; nMirAn, 27/53; $P = 0.048$), decreased intraoperative vasospasm (MirAn, 1; nMirAn, 11) in the MirAn group. Development of infarct was significantly less in the MirAn group ($P = 0.027$) with a better outcome (13 in MirAn and 26 in nMirAn had good outcome; $P = 0.048$).**

■ CONCLUSIONS: **MirAns are not significantly associated with risk factors such as age, hypertension, and diabetes. Intraoperative rupture, vasospasm, and infarct are less common, with a tendency towards better neurologic outcome compared with nMirAns.**

INTRODUCTION

The incidence of multiple intracranial aneurysms (MIAs) in patients with subarachnoid hemorrhage (SAH) is 15%–35%.[1-5] Mirror aneurysms (MirAns) are a subgroup of MIAs wherein aneurysms occur bilaterally on similarly named vessels. It is a rare subset, accounting for nearly 5% of all intracranial aneurysms; however, in certain series, it comprises up to 40% of MIAs.[6] MirAn frequently involve middle cerebral arteries (MCAs), pericallosal, and internal carotid arteries (ICAs).[6-9] Although MirAns are a subset of MIAs, whether there are any differences in their surgical management, especially of intraoperative events, compared with MIAs in general is not clear in the literature. Through this retrospective analysis, we studied the clinicoradiologic characteristics of this entity and identify peculiarities in surgical management compared with multiple aneurysms.

METHODS

A retrospective analysis of data collected over the 9 years from January 2006 to April 2015 at a tertiary-care referral centre in India was performed. All patients with SAH with proven MIAs, on computed tomographic angiography (CTA) or digital subtraction

Key words
- Infarct
- Mirror aneurysms
- Outcome
- Vasospasm

Abbreviations and Acronyms
Acomm artery: Anterior communicating artery
CTA: Computed tomographic angiography
DACA: Distal anterior cerebral artery
DSA: Digital subtraction angiography
GOS: Glasgow Outcome Score
ICA: Internal carotid artery
MCA: Middle cerebral artery
MIA: Multiple Intracranial aneurysm
MirAn: Mirror aneurysm
nMirAn: Nonmirror aneurysm
Pcomm artery: Posterior communicating artery
SAH: Subarachnoid hemorrhage

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angiography (DSA), and who underwent surgical clipping/trapping/wrapping for at least 1 of the aneurysms were included in the analysis.

Patients with MIA were divided into 2 group: MirAn and non-mirror aneurysm (nMirAn). MirAn were defined as patients with aneurysms occurring bilaterally and symmetrically on similarly named vessels. Patients with associated arteriovenous malformations or moyamoya disease were not enrolled for study. Patients with either traumatic or mycotic aneurysms or those managed by endovascular approach alone were also not included.

Clinical features (eg, age, duration of ictus, sentinel headache, and seizures) were noted from the hospital files. The time from ictus was graded into 3 groups (<4, 4–21, >21 days) to reflect the risk of vasospasm. Hunt and Hess grade at admission was recorded and defined as good for grades 1 and 2 and poor for grades 3 and higher.

Rupture status was defined as presence of SAH on noncontrast computed tomography in a patient with clinical presentation of sudden headache and proven aneurysm on DSA/CTA study.

The radiologic assessment included likely ruptured site, Fisher grade, location, and characteristics of aneurysm (as per CTA or DSA). The site of ruptured aneurysm was established in the preoperative period based on the pattern of SAH ± local parenchymal bleed or presence of daughter aneurysm. Presence of vasospasm was considered indirect evidence for likely ruptured site. The data were noted from the available radiology, indoor files, and discharge summaries of the patient.

All patients were admitted and managed in the intensive care unit and were managed by a care team comprising neurosurgeons and neuroanesthetists. The preoperative as well as postoperative assessments were carried out by the neurosurgery residents/faculty members of the team. The surgical clipping was carried out by the senior members of the surgery team (A.M./K.K.D./A.K.S./R.N.S./A.K.J./S.B.).

All patients underwent craniotomy and clipping of the ruptured aneurysm and were given the option of coiling versus clipping at admission. Analysis here includes all those patients who underwent surgical management for at least 1 of the aneurysms. The likely ruptured aneurysm was approached first for clipping. A single session management was preferred for associated ipsilateral multiple aneurysms. Staged craniotomy was preferred for the contralateral unruptured aneurysm.

Intraoperative findings such as anatomic variation of circulation, rupture of aneurysm, lamina terminalis decompression, and need for temporary clipping, were noted (from the surgeon's notes). Patients requiring surgical interventions for reasons other than securing contralateral unruptured aneurysm were noted. Intraoperative rupture during surgical dissection/approach and intraoperative vasospasm (the surgeon's subjective impression of the change in the diameter of the concerned vessel) was documented from the surgeon's notes.

The postoperative course was assessed for use of triple H therapy (hypertension/hypervolemia/hemodilution), evolution of new-onset neurologic deficit (especially infarct/hydrocephalus and electrolyte abnormalities), wound complications, and sepsis. Depending on the aneurysm characteristics, clinical status after first surgery, and financial status of the patient, contralateral aneurysm was managed either by endovascular methods or by surgical intervention.

Patient outcome was assessed in terms of Glasgow Outcome Scale (GOS) at 1 month follow-up. Patients who did not present in the outpatient department were assessed for functional outcome telephonically.

The outcome of patients on the GOS was stratified as favorable (score of 4 and 5) for a functionally independent or moderately disabled patient. Outcome was labeled unfavorable (GOS score 1–3) for a functionally dependent patient requiring constant nursing care or if the patient died.

Statistical Analysis

To test the association between variables, the Pearson χ^2 test or Fisher exact test was used. The risk (odds ratio) was calculated by using a univariate logistic regression model and a P value less than 0.05 was considered to be statistically significant. Statistical analysis was performed using SPSS (Statistical Package for Social Sciences) version 20 (IBM Corp., Armonk, New York, USA).

RESULTS

A total of 801 patients with aneurysmal SAH were operated on at our center from January 2006 to April 2015, 70 of whom had multiple aneurysms. MirAns were seen in 17 patients, with a prevalence of 2.1% of all the aneurysms and 24.3% of multiple aneurysms. There was a predominance of women in both the groups (MirAn group, 13/17; nMirAn group, 38/53; $P = 0.70$). The mean age of patients with multiple aneurysms was 49.41 years (MirAn group, 52.0 years; nMirAn group, 48.58 years). Women presented at a later age compared with their male counterparts in both groups (MirAn group, 52.85 vs. 49.25 years; nMirAn group, 49.95 vs. 45.13 years) (Table 1).

The average time from ictus was 10.18 days (range, 3–25 days; Table 1) for the MirAn group and 7.32 days (range, 1–30 days) for the nMirAn group. Most patients presented in the period between 4 and 21 days after ictus in both the groups (8/17 in the MirAn group and 30/53 in the nMirAn group).

Most patients presented with Hunt and Hess grade II and III (Table 1) with the most common radiologic Fisher grade IV (18 in the nMirAn group and 7 in the MirAn group; $P = 0.530$). Bilateral MCA aneurysms were most common ($n = 6$) followed by bilateral ICA-posterior communicating aneurysms ($n = 5$) (Figure 1). There were 3 bilateral supraclinoidal ICA segment aneurysms followed by 2 with involvement of the bilateral cavernous/paraclinoidal segment of the ICA and 1 aneurysm of the bilateral distal anterior cerebral artery (DACA). A total of 36 aneurysms were distributed in 17 patients in the MirAn group (Figure 1).

The 2 groups did not differ significantly in mode of presentation. The distribution of symptoms such as headache ($P = 1.00$), vomiting ($P = 0.165$), seizure ($P = 1.00$), and sentinel headache ($P = 0.497$) and female gender did not differ significantly between the 2 groups. The Hunt and Hess grade distribution was also similar between the 2 groups ($P = 0.492$).

The distribution of the individual aneurysm site did not differ significantly between the 2 groups (MCA, 0.409; Posterior communicating [Pcomm] artery, 1.00; supraclinoid ICA, 0.717; cavernous ICA, 0.392; DACA, 1.00; distal MCA, 1.00; posterior cerebral artery, 1.00; vertebral artery, 1.00; posterior inferior cerebellar artery, 1.00; basilar, 0.566; ICA bifurcation, 0.584),