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Microsurgical excision of intracranial
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ABSTRACT

Objectives: Brain Arteriovenous malformations are high-flow cerebrovascular lesions with dysplastic vascular nidus, fed by arteries and drained by veins without intervening capillaries. Prevalence is 0.2% and is an important cause of intracerebral haemorrhage in about 38% of young adults. The objective of this study is to analyze surgically managed Intracranial AV malformations with respect to their demographic features, varied clinical presentations, imaging features Spetzler Martin grading and outcome.

Methods: A study of 48 patients with Intracranial Arteriovenous malformations who underwent microsurgical excision at the Institute of Neurosurgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai over a period of 5 years from July 2018 to June 2022 and extracted their data including demographic characteristics, clinical presentations, Spetzler-Martin (SM) grades, complications and outcome were assessed.

Results: Of the 48 patients treated with microsurgery, the most common 51% belongs to the age group between 21 to 40 years, left-sided is slightly more common with headache major symptom, involving Parietooccipital lobe 33% commonly, 28 (62.2%) patients initially presented with haemorrhage.

Anterior circulation artery feeders was common 68.8% and mostly drainage involving superficial venous drainage system. Based on the Spetzler-Martin (SM) grading system, the patients were graded as follows: 6(13 %) Grade I, 10(21%) Grade II, 25(52%) Grade III, 3 (6%) Grade IV and 4(8%) Grade V. Overall, 35(73%) patients had a favorable outcome, most commonly seen in Grade I, II and Grade III. Almost complete obliteration of the AVMs were achieved in all favorable outcome cases.

Conclusion: Microsurgical excision is the gold standard treatment of choice for low grade AVMs and certain high-grade AVMs with increased risk of rupture. The Spetzler-Martin grading system is a simple and effective method to estimate the risk of surgery and to evaluate the prognosis. Proper patient selection combined with appropriate preoperative evaluation, meticulous surgical technique and postoperative care all lead to reduced mortality and morbidity.

INTRODUCTION

Brain Arteriovenous malformations (AVM) are high flow cerebrovascular lesions with dysplastic vascular nidus, fed by arteries and drained by veins without intervening capillaries. Prevalence is 0.2%,

Keywords

AVM,
Spetzler Martin,
microsurgery,
ARUBA,
haemorrhage



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and is an important cause of intracerebral hemorrhage of about 38% in young adults between 20 and 40 years old (11). AVMs account for 1 to 2% of all causes of strokes, 3% of strokes in young adults, 9% SAH subarachnoid hemorrhages, and 4% of all primary intracerebral hemorrhages, but as much as one third in young adults (3). The Most common clinical presentations of AVMs are intracranial hemorrhage and seizures typically before the age of 40 years old. (4) Focal neurologic deficits occur in 1% to 40% of patients with intracranial AVMs, which can be transient, persistent or progressive. The natural history of AVM is poorly understood and its management is still controversial. Current treatment options include conservative management, surgical resection, stereotactic radiosurgery (SRS), endovascular embolization, or combinations of these treatments (multimodal therapy). Microsurgical resections remain the most effective and immediate treatment for AVMs. (15) The ARUBA, A Randomized trial of Unruptured Brain AVMs trial concluded that medical management alone is superior to medical management with interventional therapy for the prevention of death or stroke in patients with unruptured brain arteriovenous malformations followed up for 33 months. But in experienced hands, microsurgery proved to have better results, compared to other treatments which is not in line with the conclusion of ARUBA trial.

OBJECTIVES

The Objective of this study is to analyze surgically managed Intracranial AV malformations with respect to their demographic features, varied clinical presentations, imaging features and its management outcome.

METHODS

A study of 48 patients with Intracranial Arteriovenous malformations underwent microsurgical excision at Institute of Neurosurgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai over a period of 6 years from July 2018 to June 2022

The data included demographic characteristics, clinical presentations, Spetzler-Martin (SM) grades, complications and Outcome was assessed. All the patients were followed for up minimum period 1 year for rebleed/ recurrence and new deficit. Exclusion criteria - arteriovenous fistulas, vein of

Galen malformations, or spinal vascular malformations were excluded.

RESULTS

Of the 48 patients treated with microsurgery, most common age group was between 21 to 40 years (48 %) as shown in chart 1, more commonly seen in Males 68% as shown in chart 2, left sided is slightly more common with headache major symptom as shown in chart 3 and 4, involving most commonly Parietal lobe 31% as shown in chart 5, 28 (62.5 %) patients initially presented with hemorrhage as shown in chart 6 and chart 7. Anterior circulation artery feeders were common 69 % and most involved superficial venous drainage system. Based on the Spetzler-Martin (SM) grading system, the patients were graded as follows: 6(13 %) Grade I, 10(33%) Grade II, 25(44%) Grade III, 3 (6%) Grade IV and 2(4%) Grade V as shown in chart 8. Overall, 37(77%) patients had a favorable outcome, most commonly seen in Grade I, II and Grade III. Out of 48 cases AVM 4 case was associated aneurysm (8.5%) in which 3 case flow related aneurysm. Almost complete obliteration of the AVMs was achievable in all favorable outcome cases. New postop deficit was seen in 8 patients (17.7%) and death in 4 patients (8%) as shown in chart 9.

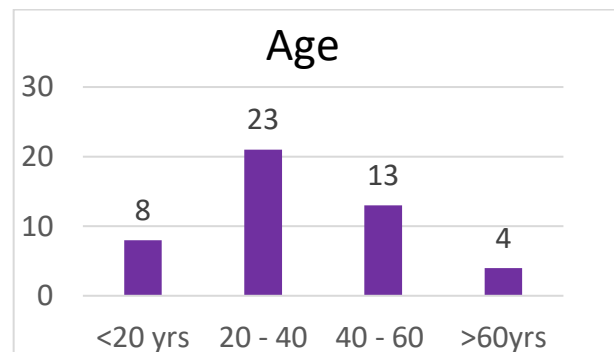
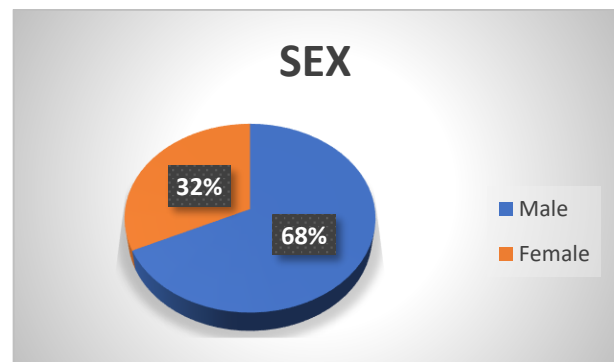


Chart 1: Age Wise Distribution. Chart 2: Sex Distribution



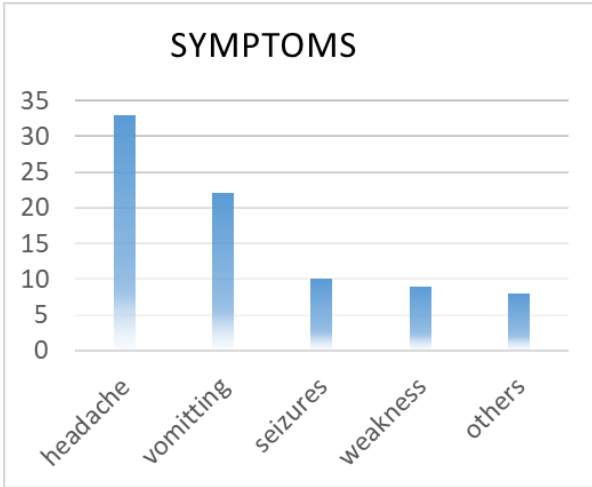


Chart 3: Symptom Wise Distribution. Chart 4: Side Involved.

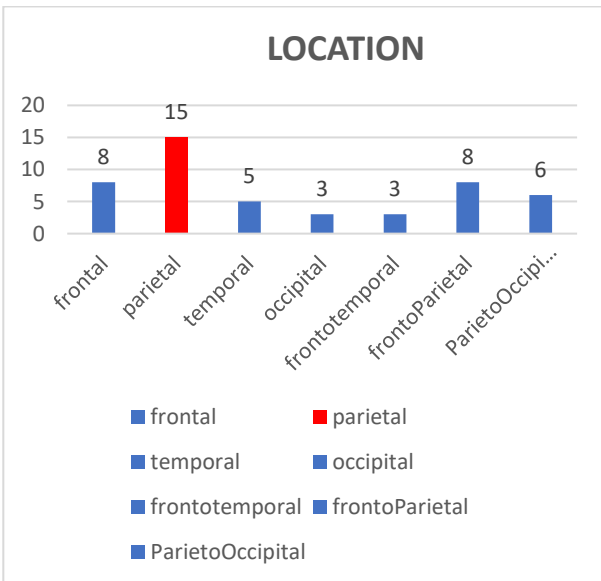
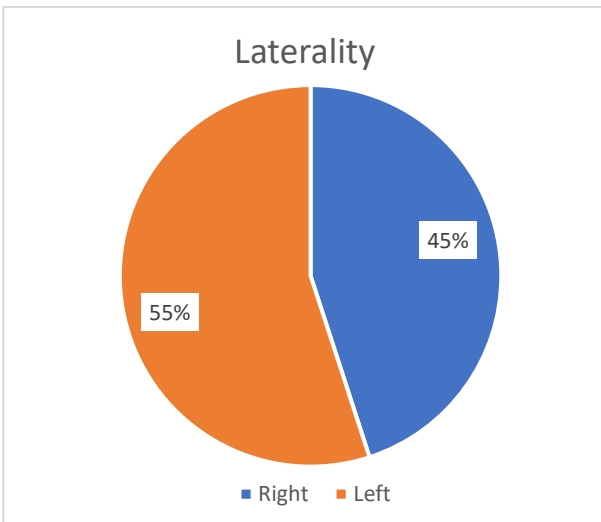


Chart 5: Location Wise Distribution

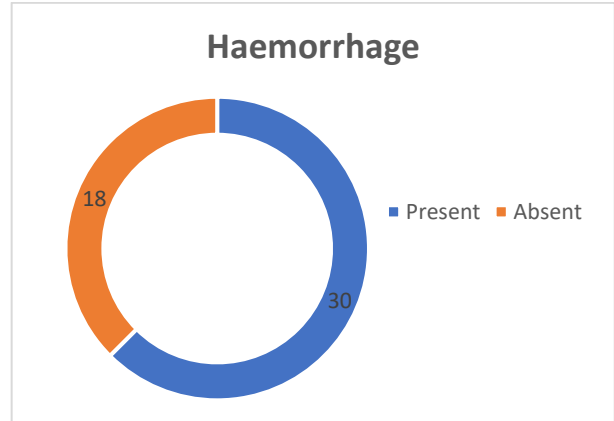


Chart 6: Incidence of Hemorrhage

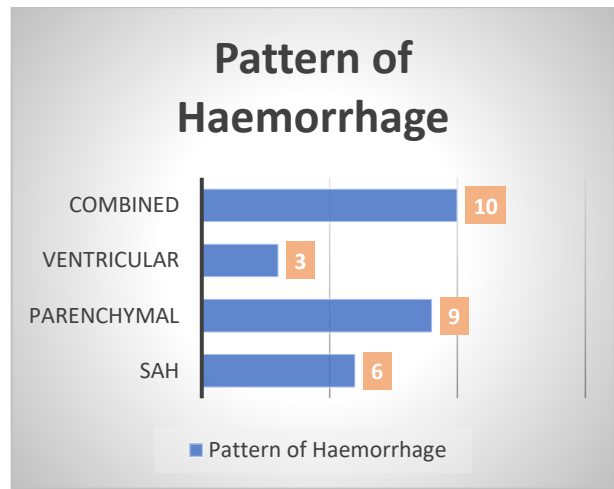


Chart 7: Hemorrhage Pattern

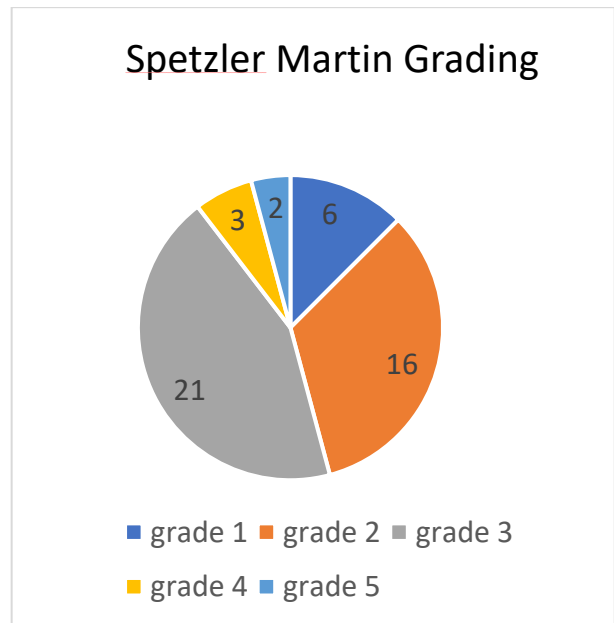


Chart 8: Spetzler Martin Grading

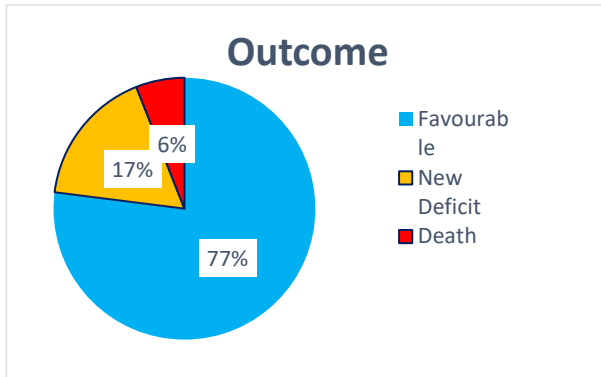


Chart 9: Outcome

DISCUSSION

Incidence of AVM is 1 per 100000, In our study male sex is commonly affected which is similar to study conducted by Zhao et al in 2005(16). Most common age group was between 20 to 40 yrs which was consistent with other studies (9). The incidence of brain AVM presenting with intracranial hemorrhage is approximately 30% to 70% (4, 7, 8,) which was similar to our study. Combined hemorrhage followed by parenchymal bleed which is similar with other study (11). Based on our results headache is more common complaint. Approximately 6% to 14% of patients with AVMs present with chronic headache without hemorrhage. A number of series have evaluated the annual risk of hemorrhage varies from 2 to 4%. Theofanis et al study 264 patients underwent microsurgery and showed rates of permanent morbidity and mortality of 1.9% and 2.7% respectively. In our study comprising 48 patients treated with microsurgical resections in a large single center, and illustrated permanent postoperative morbidity of 17.7% and a mortality of 8%. It includes even minor complications like postop hydrocephalus or a small visual field defects as deficit. All deaths were seen in patients who presented as ruptured AVM with low Glasgow coma scale underwent emergency surgery.

A Randomized trial of Unruptured Brain Arteriovenous malformations (ARUBA) is a non-blinded, multicenter, randomized trial aimed to evaluate the risk of patients with an unruptured AVM treated with medical management alone compared with interventional therapy/ micro excision surgery (17). But the results of ARUBA have provoked many debates over concerns in study design, treatment modality offered, follow-up length, and study validity [18 - 21]. Of 223 patients with interim analysis when

ARUBA was halted, 114 assigned for interventional therapy and 109 for medical management, only 5 patients were treated with standalone microsurgical excision. It's criticized that only few patients were treated surgically when 76 patients had an SM grade of 1 or 2.[18] In our study around 45% patients with SM Grade 1 or 2 received microsurgical resections and 80% had good outcome, 44% SM grade 3 underwent surgery with 70% favorable outcome.

In ARUBA Out of a total of 223 patients with a mean follow-up of 33.3 months, the primary endpoint of death from any cause or stroke occurred in 11 of 109 (10.1%) patients in the medical group compared with 35 of 114 (30.7%) in the interventional group. Almost more than threefold increased risk of stroke and death after the initiation of interventional therapy compared with medical management alone in patients with an unruptured brain arteriovenous malformation (12). In our study, the incidence of primary outcome events after microsurgical excision was favorable. Criticisms of the ARUBA study included short follow up period, lack of patient heterogeneity, lack of standardization of the treatment arm, suspected selection bias, lack of subgroup analysis, and inappropriately drawn conclusions (13). The data concerning the disparity in outcomes should affect standard specialist practice and the information presented to patients. The future AVM research and clinical trials that will continue to refine the neurosurgical treatment of this disease for the benefit of our patients.

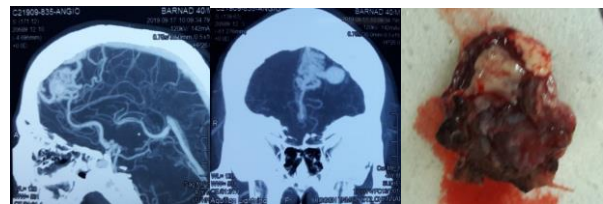


Figure 1: A case of grade 1 left frontal AVM with postop excision image.

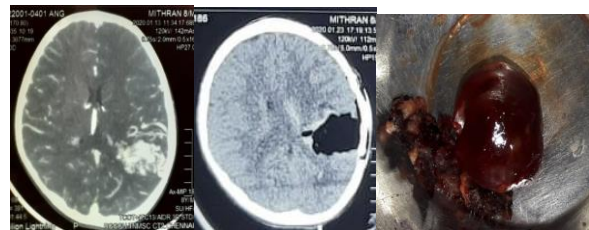


Figure 2: A case of grade 3 left parietal AVM preop and postop image.

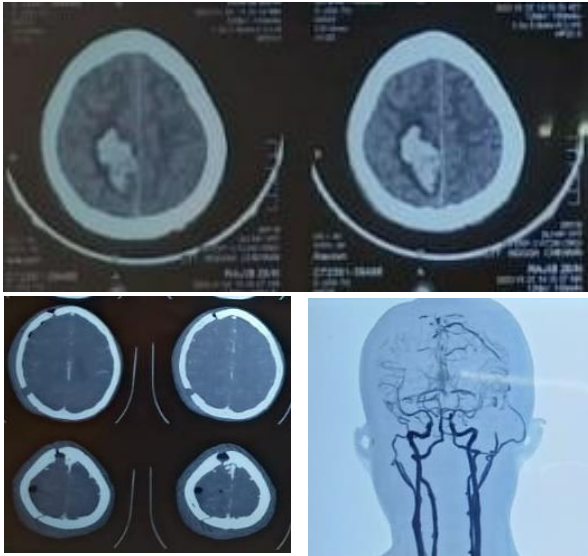


Figure 3: A case of grade 4 right frontoparietal AVM with post op complete excision image.

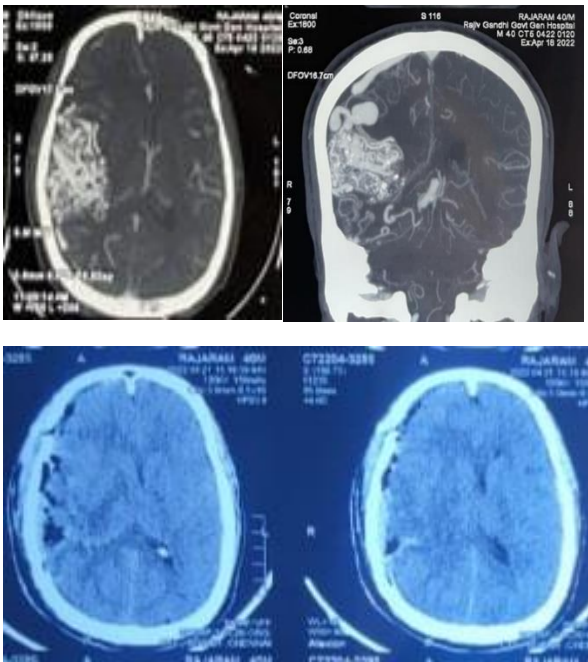


Figure 4: A case of grade 5 right frontotemporal AVM with post op complete excision image.

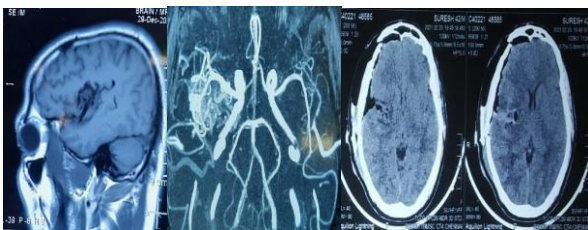


Figure 5: A case of grade 3 right insular AVM with post op complete excision image.

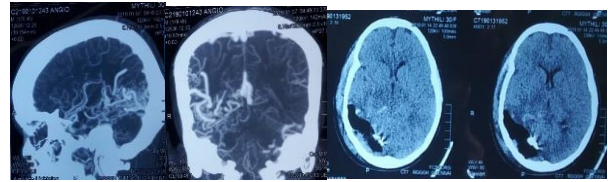


Figure 6: A case of grade 3 right occipital AVM with post op complete excision image.

CONCLUSION

Microsurgical excision is the gold standard treatment of choice for low grade AVMs and for high grade AVMs with progressive deficit, recurrent rupture. However, all the patients should be well informed about the available alternative mode of treatment and their associated risks. The Spetzler-Martin grading system is a simple and effective method to estimate the risk of surgery and to evaluate the prognosis. Proper patient selection combined with appropriate preoperative evaluation, meticulous surgical technique and postoperative care all lead to reduced mortality and morbidity.

Abbreviations

- NF1: neurofibromatosis type 1;
- WHO: World Health Organization;
- VA: vertebral artery;
- CSF: cerebral spinal fluid;
- ACDF: anterior cervical decompression and fusion.

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