CASE REPORT

Anaesthetic Management of Cerebral Arterio-venous Malformation Excision Using Awake Craniotomy: Initial Experience of Two Cases

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ABSTRACT

This case series summarises the successful management of two cases with cerebral arterio-venous malformation (AVM). In first patient, it was located superficially in right frontal cortex, while the second one had this in left parieto-temporal region. Both were excised successfully using awake craniotomy. The patients had their assessment and psychological preparation by neuro-anesthetist and neurosurgeon. Along with the routine monitoring, invasive arterial line, and bispectral index monitoring was used to monitor the sedative effect of propofol. Intraoperative analgesia was provided using scalp block. The anaesthetic management was helpful in facilitating intraoperative neurological monitoring using verbal and motor responses. Patients remained pain-free and hemodynamically stable during resection phase. The postoperative period showed adequate pain control, decreased postoperative nausea/vomiting and shorter length of stay in the hospital. Both patients had 100% obliteration of AVM confirmed *via* cerebral angiography.

Key Words: *Anaesthesia, Arteriovenous malformation, Craniotomy, Wakefulness.*

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INTRODUCTION

Cerebral vascular malformations present a variety of lesions, amongst which arterio-venous malformation (AVM) is the most common. Its estimated incidence is 1:2,000-1:5,000.[1] Due to decreased morbidity and low risk of recurrence, microsurgical excision remains the best approach in selected patients.[2] However, excision of AVM in an eloquent area is challenging, where preservation of neurological functions becomes important. Anaesthetic management can play significant role in improving outcome of these patients by facilitating intraoperative neurological monitoring. The use of awake craniotomy (AC) in this scenario is underused.[3-5] The objective of this case series is to share our experience of managing two cases of AVM excision utilising awake throughout (AT) approach. The importance of AC and its impact on intraoperative neurological monitoring, resection and outcome is highlighted in the case series.

CASE REPORT

Case 1: A 27-year female with no known comorbids, weighing 57 kg, presented with a history of generalised headache and right-sided facial nerve palsy for three years. General and systemic examination was normal. Baseline laboratory parameters were unremarkable. MRI revealed abnormal mass of vessels having "bag of worms" appearance in right frontal lobe, with central nidus measuring 13x7 mm in non-eloquent area (Figure 1). Spetzler Martin grade 1 was given to this malformation.

Case 2: A 20-year female with no associated comorbids, weighing 50 kg, presented with a history of left parieto-temporal headache and focal seizures for the past one month. General and systemic examination was normal. Baseline laboratory parameters were unremarkable. Her CT scan and angiogram showed left parieto-temporal AVM having surrounding gliosis and intra-nidal aneurysm (Figure 2A and B). It was given grade 3 on Spetzler Martin AVM grading system.

An AC was planned, for which patients had preoperative assessment and psychological preparation by neuro-anesthetist. SBAR (Situation, background, assessment and recommendations) approach was used to declare patients' willingness to proceed with awake option. They were explained thoroughly regarding procedure, operating room setup and provided with education brochure to familiarise themselves with forthcoming events. Routine American Society of Anesthesiologist (ASA) standard monitoring was instituted. An invasive radial arterial line and a large bore IV cannula was also placed. Supplemental oxygen was given *via* nasal prong @ 2 L/min of flow. Scalp block was done using

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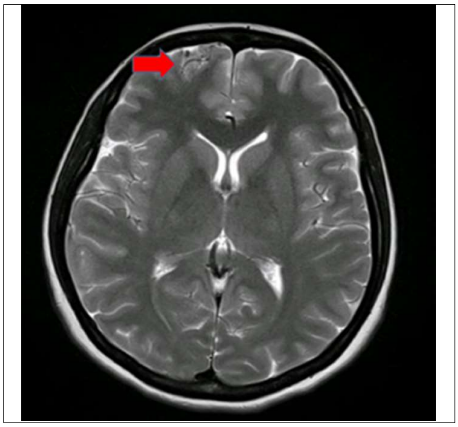

Figure 1: MRI image showing small bunch of vessels with dilated veins in right frontal lobe.

Figure 2A: Left parieto-temporal arteriovenous malformation.

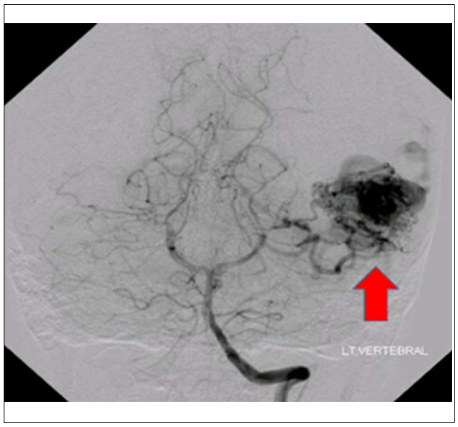

Figure 2B: AV malformation in left temporal region measuring 26 x 14 mm.

anatomical landmark technique targeting individual nerves.[5] After confirmation of block, Mayfield surgical pins were applied. Propofol infusion was used for conscious sedation at the rate of 1.5 - 2 mg/kg/hr. The level of sedation was guided by bispectral index (BIS), the target score of which was kept between 80-90. Dual antiemetic prophylaxis was provided using ondansetron and dexamethasone, 0.1 mg/Kg. Anti-epileptic prophylaxis was given using levitracteatum 1g, intravenously. Besides, ice-cold ringer lactate solution was made ready to treat any seizure activity during the procedure. Cortical stimulation was done using unipolar electrode. Intraoperative neurological functions were evaluated by monitoring verbal and motor responses. Patients remained hemodynamically stable and pain-free during resection phase and throughout the procedure. Intraoperative blood loss was 150 and 350ml respectively, while the surgery lasted for 160 minutes in the first patient, and 270 minutes in the second. Post-anesthesia care unit (PACU) stay was uneventful, and both patients were discharged to a special care unit (SCU) and to home after confirmation of cerebral angiography, which revealed no residual malformation. The postoperative analgesia was prescribed with intermittent doses of paracetamol and tramadol. The first patient was discharged at second postoperative day (POD). The second patient developed transient aphasia during postoperative stay at SCU. This was resolved completely after 48 hours, and she was discharged on 4th POD.

DISCUSSION

The use of AC for excision of cerebral AVM is underutilised, which is evident in current literature either by isolated case reports or retrospective studies. A recent study from Hong Kong shared their retrospective data of 13 years, during which they have done six cases using AC. They shared the significance of awake approach for intraoperative neurological monitoring and its association with higher obliteration rate. Gamble *et al.* reported their six-year experience, where they have done 42 AVM repairs. AC was associated with better surgical cure and proven to be useful for intraoperative neurological monitoring. The use of AC is recently being utilised at our healthcare set up for excision of supra-tentorial tumors near eloquent cortex.[5] It has been found to be useful. The extension of this technique for cases like AVM and clipping aneurysms is a step ahead toward better care and resource utilization for underdeveloped countries. Chan *et al.* emphasised the conduct of AVM repair under AC. They concluded that the success of procedure was dependent upon two factors, *i.e.* anaesthetic competence and cooperation of the patient.[3] At our institute, all patients scheduled for AC are assessed by neuro-anaesthestist. This includes a review of a patient's education brochure in first instance; followed by detailed presentation depicting theatre setup, scalp block and sharing of patient experiences. As mentioned above, this is based on SBAR approach. In our first case, patient had AVM in non-eloquent area. In this patient, AC was offered because of its superficial location and secondly to provide hemodynamic stability. We know that local hemodynamic changes in brain due to AVM cause vasodilation of adjacent vessels for preservation of perfusion. After repair of low resistance AVM, adjacent vessels are exposed to higher pressures. Thus, normal perfusion pressure breakthrough may happen, as adjacent vessels are unable to autoregulate in normal pressure range due to disrupted autoregulation. This can cause hemorrhage. That is why strict blood pressure control is advised, which is really difficult to manage in patients with general anaesthesia (GA). That may be an added advantage of using AC for neurosurgical cases, where its efficacy can be predicted by low complication and failure rate in comparison to GA.[6] Besides, AC is also associated with decreased incidence of postoperative nausea and vomiting, which is again beneficial to blunt hemodynamic responses in these cases. In our second case, AC was offered for intraoperative neurological monitoring, which was done

successfully. Pre-surgical AVM embolisation was done that might lead to increased probability of complete obliteration.[7] In the presence of an associated aneurysm, deep venous drainage and deeper location of AVM; the risk of subsequent hemorrhage is increased.[7] To blunt the hemodynamic and stress response to Mayfield pins, AC was the best option.[8]

Postoperative course of these patients showed significant reduction in pain score and an overall reduction in length of stay at PACU, SCU and in the hospital. Both of which are the reported advantage of using AC.[9] There are reports of neurological dysfunctions even by opting awake approach. Zhou *et al.,* in their retrospective study were unable to find any differences in neurologic dysfunction.[10] For AVM in a functional area, they reported three cases of postoperative aphasia despite normal intraoperative course. Our second patient also suffered postoperative aphasia but it was settled within two days. Gamble *et al.*, in their case series of four patients, reported one case of post-operative dysphasia. This was recovered within 6 weeks.[4] Though AC is best for resection of selected AVM cases, we need randomised controlled trials to determine its overall benefits including the neurological outcome, cost and satisfaction related to technique.

AC is a suitable option for selected AVM excisions, which lie either superficially or in eloquent cortex. The approach is useful in facilitating intraoperative neurological monitoring, providing hemodynamic stability and quality analgesia. The benefit of technique needs to be explored in terms of cost including the length of stay in the hospital.

PATIENTS' CONSENT:
Written and informed consents were obtained from both the patients to publish the data.

CONFLICT OF INTEREST:
Authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
WBG: Manuscript writing, submission, proofreading.
KA: Data collection.
FS: Manuscript writing, proofreading.
AE: Patient recruitment, surgical input.

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