Surgical management of scalp arteriovenous malformations using a novel surgical technique—Case series

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ABSTRACT

INTRODUCTION: Scalp AVM (SAVM) is a rare condition. Although surgical excision is considered as definitive treatment for these lesions, troublesome intraoperative bleeding may pose a challenge. Embolization as an alternative modality is gaining popularity. Proximal feeding artery temporary clipping has been utilized by the authors in this series to address troublesome intraoperative bleeding.

PRESENTATION OF CASES: The authors present their experience in the surgical management of 3 cases with SAVMs using proximal feeding artery temporary occlusion followed by total surgical excision. The clinical presentations and radiological features of these cases are discussed in the article. Intraoperative blood loss was less than 150 ml in all patients. Postoperative period was uneventful with no morbidity or mortality.

DISCUSSION: Intraoperative bleeding during surgical excision of scalp AVMs can be troublesome and challenging. To combat this, the authors advocate proximal feeding artery temporary clipping prior to surgical excision of the lesion. The external carotid artery was temporarily clipped in one case and superficial temporal artery in two patients.

CONCLUSION: Although most SAVMs can be operated by traditional method of excision, use of temporary clipping of feeding arteries (like Superficial temporal artery[STA], External carotid artery[ECA]) enables total excision of giant SAVMs with minimal blood loss for a definitive cure. This novel technique obviates the need for preoperative embolization.

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1. Introduction

AVM is an abnormal fistulous connection between the feeding arteries and draining veins without an intervening capillary network [1–3]. Although SAVMs are rare, they still account for 50% of integumental AVMs [1,2,4]. A progressive growing pulsatile mass, bruit and a throbbing headache are the usual complaints of the patient [2]. Treatment options of SAVMs include surgical excision, trans-arterial or trans-venous embolization and injection of sclerosants into nidus[1,2,4–6]. However, only total surgical excision offers a cure to these lesions. Due to excessive and troublesome intraoperative bleeding, endovascular procedures are gaining popularity but are associated with high incidence of recanalization. The endovascular option is considered curative only in smaller AVMs and single hole fistulas. In large AVMs they offer only a palliative option [7].

This study describes our experience of treating 3 patients using proximal control (by temporary clipping of main feeding arteries) where complete excision was possible with minimal blood loss and good outcome. This study is reported in line with SCARE criteria [8].

2. Case series presentation

Three patients (two females & one male) with ages ranging from 12 to 50 years were treated for SAVMs in our institution which is a tertiary care, state run teaching institute. All patients presented with pulsatile mass over scalp with associated headache. Preoperative angiography (internal and external carotid) was performed in all patients to determine the feeding vessels and anatomical extent of lesion (Fig. 1). None of the patients had an intracranial extension of pathology. Patient details are enumerated in Table 1.
2.1. Operative technique

All cases were optimized and taken up for surgery electively. Detailed informed consent was taken from each patient. As the surgery done is a standard well established procedure, no separate ethical approval was necessary. All the three surgeries were done by the senior author (third author). Patients were placed in supine position with head elevated 30° above heart level. Scalp flap was devised depending on the anatomy of the nidus & the direction of feeding vessels. In a case of left temporal SAVM a separate vertical incision was put on left side of neck to expose ECA for proximal control. In two patients, superficial temporal artery was exposed and temporary clip applied for reducing vascularity of the lesion. The scalp flap was raised along with pericranium. Dissection was done in subgaleal plane. The feeding arteries were identified along their course at base of scalp was temporarily clipped with a bulldog clamp. The nidus was then excised in toto (Fig. 2). In one patient, a scalp defect resulted due to circumferential dissection of the nidus. This was closed using a rotation flap with the help of a plastic surgeon (Fig. 3).

2.2. Post-operative management

All patients were administered appropriate antibiotics and analgesics. Follow up of these patients ranged from 24 to 36 months.

2.3. Results

Total excision of the SAVMs was achieved in all three cases. Intraoperative blood loss was less than 150 ml in all patients. All three patients had a good outcome with complete healing of the scar. No adverse effects were noted due to temporary occlusion ECA or STA. Post-operative period was uneventful. No recurrence or residual was noted clinically in any of the patients.

| Patient No | Age/sex | Location              | Clinical features | Duration of symptoms | Feeding arteries | Surgical procedure         | Blood loss |
|------------|---------|-----------------------|-------------------|----------------------|-----------------|---------------------------|------------|
| 1.         | 30/F    | Left temporal region  | Pulsatile mass,   | 10 years             | ECA             | Complete Excision          | <100 ml    |
|            |         |                       | headache          |                      |                 |                           |            |
| 2.         | 50/F    | Right frontal region  | Pulsatile mass,   | 10 years             | Bilateral STA   | Complete Excision          | <150 ml    |
|            |         |                       | headache, bruit   |                      |                 |                           |            |
| 3.         | 12/M    | Left occipital region | Pulsatile mass    | 3 years              | Occipital artery| Complete Excision          | <150 ml    |

Table 1: Shows clinical and operative details of patients.
Fig. 2. Intra-operative images of patient 1. (A) Left side frontotemporal skip flap is reflected to expose the temporalis muscle containing the AVM. (B) Temporalis muscle containing the AVM being exposed. (C) The left external carotid artery is exposed for proximal control. (D) AVM completely excised with the temporalis muscle. (E) Excised specimen and wound closure (F).

3. Discussion

SAVMs are abnormal arteriovenous communication present in subcutaneous fatty layer of the scalp [4]. It is generally accepted that pathogenesis is either congenital or traumatic in origin with the former being more common [2,4,9]. SAVMs are distributed equally among frontal temporal and parietal regions of the scalp [4]. Main source of arterial supply is from the ECA through superficial temporal artery and occipital artery [4].

Developmental arrest of the scalp vascular system in the capillary network stage results in formation of a hemangioma [2]. The persistence of connections of the embryonal capillary network in
the later stage leads to the formation of intercommunicating channels of varying forms between mature arteries and veins. This may result in formation of SAVMs [2].

Clinical manifestations relate primarily to size of fistula and patients may present with loud bruit, hemorrhage and throbbing headache[1,4]. Digital Subtraction Angiography (DSA) is the gold standard investigation in diagnosis and delineating the lesion and to exclude an intracranial extension [4,9].

Management of SAVMs is difficult and challenging due to their high shunt flow, complex vascular anatomy and cosmetic problems [1,2,4]. Indications for treatment includes cosmetic, relief of pulsating mass and headache and prevention of hemorrhage.

Treatment options include surgical excision [1,2,4], trans arterial and trans venous embolization [5] and intranidal injection of sclerosant [6]. Surgical excision is the most common and successful method of dealing with SAVMs [1,3–6]. Various techniques have been used to control hemorrhage during surgery like percutaneous suture of feeding vessels and interlocking suture along line of incision [2]. Preoperative embolization has been advocated by some to reduce intraoperative blood loss [4,5]. We have used temporary occlusion of the main feeding artery to decrease the vascularity of the lesion. No adverse effect was noted by temporary occlusion of ECA or STA. Blood loss in all cases was less than 150 ml. All three cases had complete excision of SAVMs. Hospital stay too was reduced. All this reflected in the reduced treatment cost of these patients. This method also obviates the chances of recurrence which is seen in endovascular embolization when used as a standalone treatment technique for these lesions [4–6]. This novel technique of temporary arterial occlusion has not been reported in literature to the best of our knowledge.

The key strengths of this study are that it is a novel but scientific study and results have been gratifying in an otherwise technically difficult surgery. Appropriate pre-operative work up and imaging were done in all cases. Our main limitation was the small patient number.

4. Conclusion

Management of SAVMs should be customized based on their size, angioarchitecture and clinical presentation. Most scalp AVMs can be completely excised thus offering a cure for their lesion. Temporary occlusion of the feeding arteries helps in excision by decreasing blood loss and excision time.

Conflict of interest

Nil.

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Ethical approval

Not applicable.

Consent

Written informed consent for the purpose of scientific publication has been taken from all patients and all efforts have been made to protect their identity.

Author contributions

Srihari Bangalore Gangadharswamy: Data Collection; Writing. Nagarjun Maulyavantham Nagaraj : Data Analysis; Writing. Balaji Sanjeev Pai: Concept and Design; Writing.

Guarantor

Dr. Balaji Sanjeev Pai.

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