SAGE Open Medical Case Reports
Volume 12: 1–4

DOI: 10.1177/2050313X241239531
journals.sagepub.com/home/sco
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Parieto-occipital scalp arteriovenous malformation with drainage into the posterior superior sagittal sinus: A case report

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Abstract

This case report presents the unique clinical presentation of an 18-year-old female patient with an 8-year history of a progressively enlarging pulsatile mass in the left parieto-occipital region of her scalp. Remarkably, there was no history of trauma, headache, or other associated neurological deficits. Advanced imaging techniques, including computed tomography angiography and magnetic resonance imaging, revealed a vascular lesion consistent with an arteriovenous malformation beneath the scalp. Notably, the arteriovenous malformation's nidus was primarily supplied by branches of bilateral superficial temporal and occipital arteries, with a more pronounced involvement on the left side. Further magnetic resonance imaging characterization confirmed the diagnosis as a high parieto-occipital arteriovenous malformation/dural arteriovenous fistula. This case underscores the importance of a multidisciplinary approach involving neurosurgery and interventional radiology to the diagnosis and management of complex vascular lesions, particularly when they occur in unusual anatomical locations, like in our patient. The long-term clinical course and outcomes of such cases warrant continued investigation.

Keywords

Scalp, arteriovenous malformations, parietal lobe, occipital lobe, dural arteriovenous fistula

Date received: 30 December 2023; accepted: 27 February 2024

Introduction

Arteriovenous malformations (AVMs) are vascular abnormalities arising from unusual connections between arteries and veins, bypassing the capillary beds.[1,2] When found on the scalp, these lesions can have diverse clinical appearances and might be initially misdiagnosed. In severe cases, if left untreated, they can result in gradual disfigurement.[3]

AVMs can be attributed to two main causes: trauma or congenital factors. Clinical symptoms typically encompass a pulsating mass, headaches, local pain, numbness, tinnitus, and occasionally necrosis and hemorrhage.[4] AVMs that develop spontaneously are typically present from birth but often go unnoticed until they start causing cosmetic concerns during adulthood.[4] Due to their extensive flow-related irregularities, these conditions may exhibit associated arteriovenous fistulas (AVFs), connections between intracranial and extracranial vessels, or vascular abnormalities within the cranium.[1] Clinical symptoms may worsen as the lesions enlarge, leading to functional, cosmetic, and psychological issues caused by the mass resulting from vascular abnormalities.[5]

Herein, we present the case of an 18-year-old female with an asymptomatic presentation of an enlarging AVM in the parieto-occipital region. Notably, the patient did not experience headaches, seizures, or visual symptoms. The case was successfully managed through surgical resection, resulting in the complete removal of the lesion.

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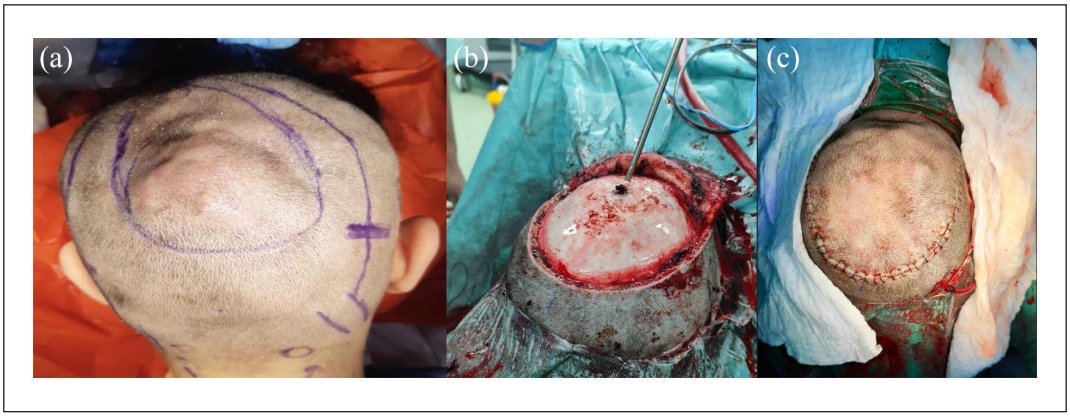

Figure 1. Preoperative (a), intraoperative (b), and postoperative (c) images depicting the patient's scalp. Image (a) illustrates a high parieto-occipital mass with associated skin redness. The figure also illustrates the planned horseshoe incision, (b) captures the surgical procedure, and (c) displays the postoperative outcome following complete excision of the AVM.
AVM: arteriovenous malformation.

Case presentation

An 18-year-old female presented to the hospital with a complaint of an increasingly enlarging, pulsatile mass in the left parieto-occipital region that has been present for 8 years. Initially small and asymptomatic, the mass started growing 8 years ago. There was no history of trauma, seizures, headache, visual symptoms, or other medical conditions. Vital signs were within normal limits. Upon examination, a pulsatile mass was noted (Figure 1), and no abnormalities were found during the neurological examination. The computed tomography angiography (CTA) scan demonstrated a lesion of a vascular nature measuring about 3 cm × 2 cm, presumably an AVM beneath the scalp (Figure 2). The nidus was fed by branches from bilateral superficial temporal and occipital arteries.

Cerebral magnetic resonance angiography (MRA) showed a vascular lesion suggestive of a high parieto-occipital scalp AVM/dural AVF, with dilated feeding arteries arising mainly from the left occipital artery, in addition to collateral from the right occipital artery and bilateral superficial temporal arteries (STA), which appear to drain into the superior sagittal sinus (Figure 2).

For a more thorough evaluation of the lesion and to minimize intraoperative complications, a combined approach involving digital subtraction angiography (DSA) followed by surgical resection was done. DSA of the internal and external carotid arteries revealed evidence of shunting with arterial supply from bilateral superficial temporal and occipital arteries (Figure 2). The patient's AVM was determined to be type 3A according to Yakes classification of AVMs.[6] No additional procedures or interventions were performed during this process.

The surgical approach involved precise infiltration of the skin incision site with local anesthesia for optimal patient comfort. A horseshoe-shaped incision was made through the skin layers, reaching down to the bone and the occipital subgaleal region to access the AVM. Careful dissection of the AVM ensued, followed by the ligation and complete excision of the feeding vessels to ensure thorough removal. Postoperative care included a comprehensive 1-month observation period within the surgical department, during which the patient exhibited a smooth recovery without encountering any complications. A scheduled follow-up after 3 months was arranged to conduct a brain magnetic resonance imaging (MRI), aiming to monitor the patient's ongoing recovery progress and assess any long-term outcomes.

Discussion

Scalp AVMs are rare vascular abnormalities with an unclear cause.[1,7] These vascular anomalies originate during fetal development when embryonic blood vessels fail to properly form into arteries and veins, but about 10%–20% of scalp AVMs are classified as traumatic.[8,9]

The absence of neurological deficits suggests a relatively stable clinical course, prompting questions about the natural history of such lesions. Symptoms of AVM may arise due to abnormal perfusion and mass effect.[10] While AVMs can remain asymptomatic for many years, they may eventually lead to serious complications, including bleeding, seizures, intracranial hemorrhage, and neurological deficits.[11] Despite the enlarging mass in our patient, she did not experience headaches, visual field deficits, or seizures.

Physical examination frequently reveals the presence of AVM, and its diagnosis is typically confirmed through imaging techniques such as CTA and MRI.[1] However, the gold standard image for diagnosis is DSA.[1,5] MRA is a modern modality to evaluate scalp AVM lesions, and it can detect if the bone is involved. On T1 and T2 weighted magnetic resonance images, the lesion appears as enlarged, convoluted vascular structures displaying signs of disrupted blood flow.[4] Selective angiography is advised for distinguishing AVM from various conditions, such as

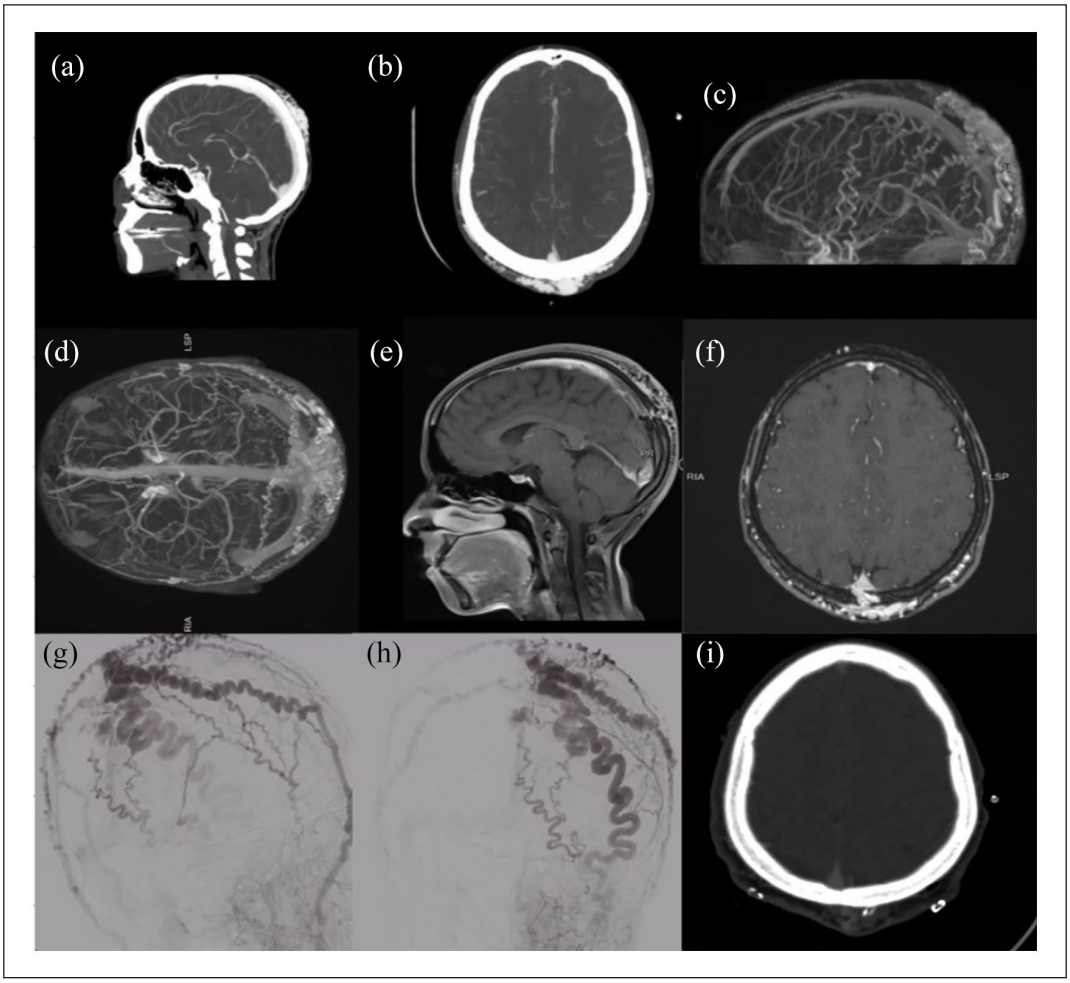

Figure 2. Preoperative imaging and postoperative outcome of the patient's parieto-occipital AVM. Selected axial (a) and sagittal (b) cuts from brain CT angiography performed on the patient reveal an AVM with the nidus situated at the occipital scalp, measuring approximately 3 cm × 2 cm. The nidus is supplied through enlarged serpiginous superficial temporal and occipital arteries bilaterally with no evidence of skull involvement.

Reconstructed MRA images of the brain with sagittal (c) and axial (d) views better demonstrate the AVM. The nidus appears as a thick mesh of serpiginous vessels located at the posterior scalp and fed by branches from enlarged torturous STAs and occipital arteries bilaterally. The T1W image with IV contrast-sagittal view (e) demonstrates that the nidus drains into the posterior aspect of the superior sagittal sinus, which is also evident by the axial cut selected in picture (f). There is no evidence of intracranial extension of the AVM. DSA with anteroposterior projection of the left external carotid artery injection, demonstrating the involved left STA with no intracranial involvement. The lateral projection of the right external carotid artery injection demonstrates similar findings compared to the left side (g, h). (i): Postoperative head CT scan of the AVM.

CT: computed tomography; AVM: arteriovenous malformation; MRA: magnetic resonance angiography; STA: superficial temporal arteries; DSA: digital subtraction angiography.

venous malformation, aneurysms, cavernous hemangioma, and sinus pericranii.[1,2]

The treatment of AVMs is typically individualized and depends on the size, location, age, and status of the AVM lesion.[12] Treatment options may include embolization, surgical resection, or a combination of both, with the ultimate goal of reducing the risk of complications and improving the patient's quality of life.[5] Various approaches can be used to treat scalp AVMs, including surgical removal, ligation, transarterial and transvenous interventions, direct puncture embolization, and electro-thrombosis.[7,13]

Surgical intervention is recommended, especially to prevent bleeding and cosmetic problems. Recurrence remains a possibility over an extended period due to the presence of feeding collaterals as a cause of incomplete surgical resection.[13] Regarding surgical procedures, typical complications include bleeding, necrosis of the scalp, and sepsis resulting from wound infections.[9]

Endovascular treatment is more suitable for lesions under 4 cm that have a restricted number of feeding and draining vessels.[5] It can be utilized to minimize bleeding and improve the efficacy of surgical procedures.[8]

Given that our patient was not from the local area, follow-up assessments beyond the initial postoperative period posed logistical challenges. Despite this limitation, the observed smooth recovery during the initial postoperative period provided positive indications, and efforts were made to coordinate with healthcare providers for continued monitoring of the patient's long-term outcomes.

Conclusion

This case report highlights the importance of a thorough diagnostic workup, including advanced imaging techniques like CTA and MRI, in the evaluation of complex vascular lesions. It also emphasizes the need for a multidisciplinary approach to treatment and long-term follow-up in cases of AVMs and dural AVFs, particularly when they present in unusual locations, as seen in our patient. Further studies and long-term observations will provide valuable insights into the natural history and optimal management strategies for such cases.

Acknowledgements

The authors express their gratitude to the patient and their family for their great contribution.

Authors contributions

K.I. and O.H.S. contributed to design of the study and drafting of the manuscript. O.H., A.A.H., and H.S. contributed to data collection, data entry, and data interpretation. M.A. contributed to drafting and supervision of the manuscript. S.B. contributed to design of the study, data interpretation, and supervision of the work. All authors have read and approved the final manuscript. Each author has participated sufficiently in the work to take public responsibility for the content.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Research ethics and patient consent

This case report did not require review by the Ethics Committee. Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal if requested.

Informed consent

Written informed consent was obtained from the patient for their anonymized information to be published in this article.

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