



Surgical resection of a rare scalp arteriovenous malformation: a case report

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Introduction and importance: Scalp arteriovenous malformations (AVMs) are intricate vascular anomalies with abnormal connections between arteries and veins in the scalp, leading to serious complications and cosmetic concerns. Managing scalp AVMs is particularly complex in young female patients, where both functional and aesthetic outcomes are crucial. This case report highlights the successful treatment of a young woman with a scalp AVM, emphasizing the importance of early diagnosis and a multidisciplinary approach.

Case presentation: A 30-year-old female presented with a pulsatile scalp mass and significant cosmetic concerns. Diagnostic imaging, including ultrasonography, brain CT scan, MRI, and carotid CT angiogram, confirmed a scalp AVM. The patient underwent a comprehensive treatment plan beginning with endovascular embolization to reduce blood flow to the AVM, followed by surgical resection to remove the lesion. Postoperative follow-up showed a marked reduction in symptoms and lesion volume, with no complications observed.

Clinical discussion: Scalp AVMs, though rare, require prompt diagnosis due to the risk of severe complications such as hemorrhage and cosmetic impact. In this case, a combination of ultrasonography, CT, and MRI provided a detailed assessment of the AVM. A multidisciplinary approach, involving interventional radiology and surgical expertise, was crucial for success. Endovascular embolization minimized intraoperative bleeding and simplified surgical resection, leading to significant symptom and cosmetic improvements. Continuous monitoring is essential for long-term success and early detection of recurrences.

Conclusion: This case underscores the effectiveness of a multidisciplinary approach in managing scalp AVMs in young female patients. Early diagnosis through advanced imaging techniques enables timely and targeted intervention. The combined use of endovascular embolization and surgical resection led to significant symptom resolution and aesthetic enhancement. Collaboration among specialists is vital for optimizing outcomes, and ongoing research will further refine treatment strategies, improving the quality of life for patients with scalp AVMs.

Keywords: diagnostic imaging, endovascular embolization, multidisciplinary approach, scalp arteriovenous malformation, surgical resection, young female patient

Introduction

Scalp arteriovenous malformations (AVMs) are intricate vascular anomalies that frequently pose diagnostic and therapeutic challenges. These lesions entail abnormal connections between arteries and veins within the scalp,

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HIGHLIGHTS

- Rare case presentation: Detailed case report of a rare scalp arteriovenous malformation (AVM) in a 30-year-old female with significant cosmetic concerns.
- Comprehensive diagnostic imaging: Utilized multiple imaging modalities, including ultrasonography, brain CT scan, MRI, and carotid CT angiogram, to confirm the diagnosis and assess the AVM's extent.
- Multidisciplinary approach: Emphasizes the importance of a collaborative treatment strategy involving endovascular embolization followed by surgical resection.
- Successful outcome: Postoperative follow-up showed marked improvement in symptoms and lesion volume, with no complications observed.
- Clinical and aesthetic benefits: Highlights the critical role of early diagnosis and targeted intervention in achieving both functional and aesthetic improvements for patients with scalp AVMs.

potentially leading to severe complications and cosmetic concerns. Notably, scalp AVMs hold particular significance in young female patients due to age and gender-related considerations^[1,2].

These vascular abnormalities are rare and often manifest as seemingly innocuous subcutaneous scalp lumps with a propensity for hemorrhage. Moreover, the clinical spectrum of scalp AVMs varies, encompassing symptoms such as pulsatile masses, pain, bleeding, and cosmetic deformities^[3–5]. Timely diagnosis and appropriate management are crucial to alleviate symptoms, mitigate the risk of complications, and enhance the patient's overall quality of life. Managing scalp AVMs presents a formidable clinical challenge, particularly in young female patients^[4].

This case report aims to highlight a successful approach to managing scalp AVMs in a young female patient. A multidisciplinary strategy was employed, incorporating diagnostic imaging, embolization, and surgical resection, with a primary focus on promptly alleviating symptoms, prophylactically preventing complications, and improving aesthetics. Furthermore, this report contributes to the expanding knowledge base regarding the management of scalp AVMs by discussing and comparing various approaches currently and previously utilized, thereby enhancing our understanding of this condition and refining therapeutic plans.

Case history/examination/presentation

Case history: A 30-year-old female patient presented with a pulsatile scalp mass and significant cosmetic concerns due to visible swelling. Symptoms began 4 years ago (2020), characterized by the gradual development of a pulsatile mass on the left frontotemporal region, causing discomfort and anxiety related to aesthetic concerns. The patient did not seek medical attention until January 2024 due to personal and healthcare issues, allowing for progressive AVM evolution. Past medical history was unremarkable, with no trauma or family history of vascular malformations. She was a nonsmoker, nondrinker, leading an active lifestyle with no known occupational exposures.

Examination: Upon physical examination, a pulsatile, nontender, elliptical mass measuring ~6 cm elevated from the base with no external signs of necrosis was palpable on the patient's scalp. No neurological deficits were noted.

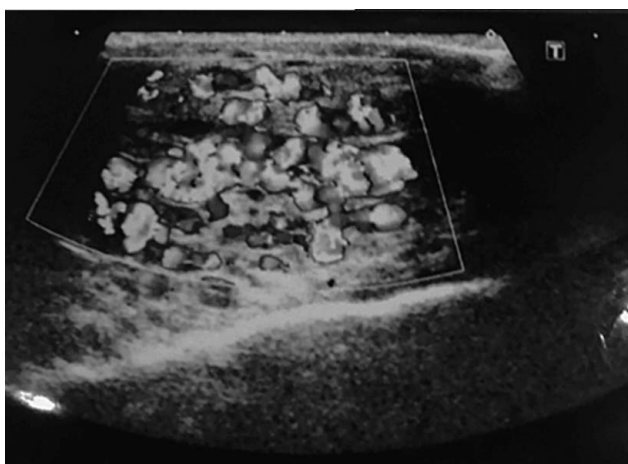


Figure 1. Ultrasonography of the left temporo-parietal scalp showing multiple tortuous serpentine vascular channels, indicative of a scalp arteriovenous malformation.

Methods (differential diagnosis, investigations, and treatment)

Differential diagnosis: The differential diagnosis included scalp arteriovenous malformation (AVM), hemangioma, and lymphatic malformation.

Investigations: various diagnostic imaging modalities were employed:

Ultrasonography revealed multiple tortuous serpentine vascular channels involving subcutaneous planes in the left frontotemporal region, extending mildly to the supra-auricular region (Fig. 1). Brain CT scan showed isodense extracranial swelling with heterogeneous enhancement post intravenous contrast in the left temporo-parietal region (Fig. 2).

MRI of the brain revealed an abnormal hyperintense signal area along the left temporo-parietal region in the subcutaneous plane, with internal flow voids likely draining into the internal jugular vein (Fig. 3).

Carotid CT angiogram demonstrated dilated tortuous vascular channels in the left temporo-parietal region, extending into various adjacent spaces and supplied by the left external carotid artery (Fig. 4).

Treatment: the patient underwent a multidisciplinary approach, including:

Endovascular embolization with Onyx liquid embolic system via the left femoral artery to the left external carotid artery. Surgical resection involved making a small incision along normal skin langerhans lines in the frontotemporal region. The scalp layer was dissected, feeding arteries, and draining veins of the AVM were identified, and the abnormal vascular tissue was removed. Bleeding was controlled, and healthy tissue was preserved. We have followed the Surgical Case REport 2023 criteria for the preparation of this case^[5].

Results (outcome and follow-up)

Following surgery, the patient experienced marked improvement in symptoms and lesion volume. Postoperative monitoring for complications was uneventful, leading to prompt discharge with regular follow-up appointments scheduled to assess the AVM's response to treatment and the patient's overall well-being. The patient was followed up fortnightly for a month postsurgery to monitor for any complications or recurrence of the AVM.

Discussion

Managing scalp AVMs presents a significant clinical challenge, especially when diagnosed in young female patients^[2–4]. This challenge involves diagnostic intricacies and therapeutic complexities due to the unique anatomical and physiological characteristics of the scalp, necessitating meticulous planning and execution^[2–4]. Additionally, the psychological impact and potential long-term effects on aesthetics further complicate the management of these cases. Therefore, a comprehensive and multidisciplinary approach involving specialists from various fields, such as neurosurgery, interventional radiology, and dermatology, is essential^[3,4,6]. Tailored treatment strategies that

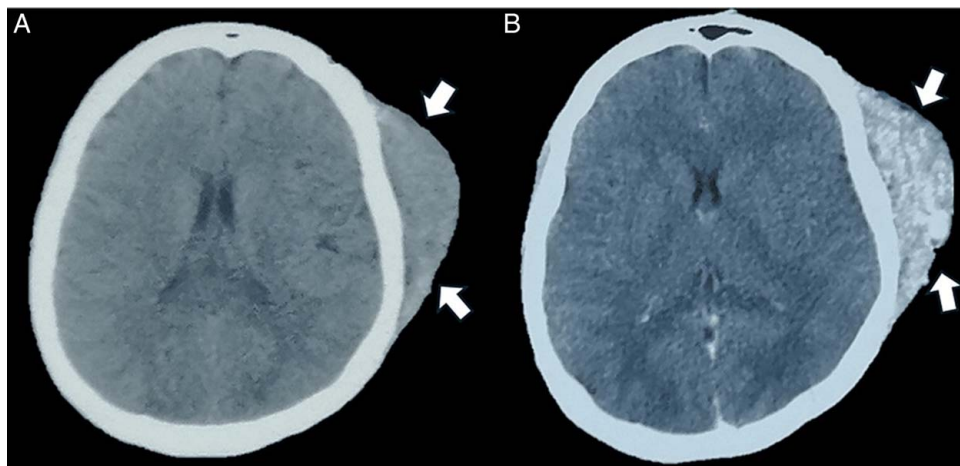


Figure 2. Computed tomography (CT) scan of the brain demonstrating a scalp arteriovenous malformation (white arrows): (A) Plain CT scan and (B) CT scan with heterogeneous enhancement following intravenous contrast administration.

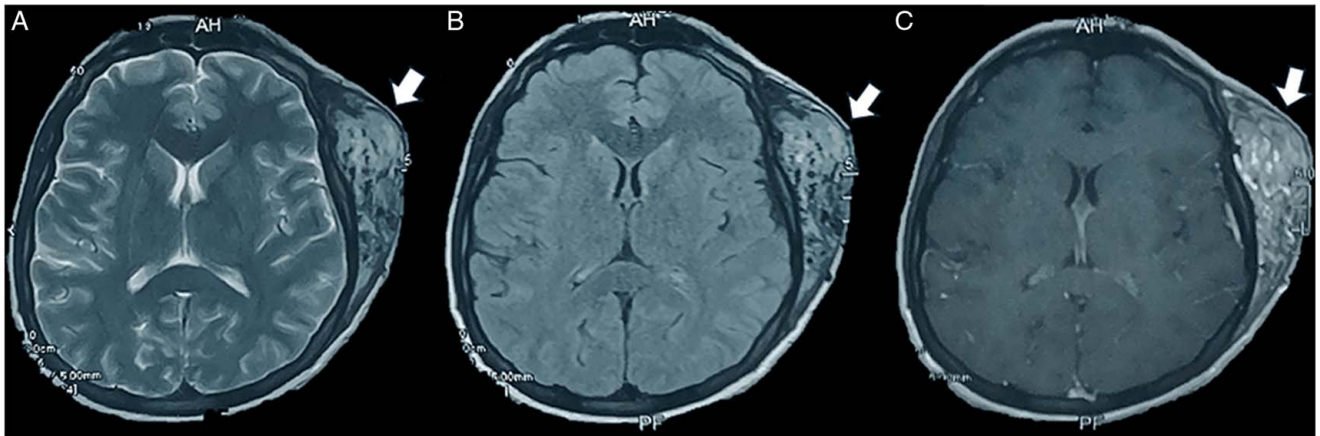


Figure 3. MRI of the brain illustrating a scalp arteriovenous malformation (white arrows): (A) T1-weighted image showing the lesion, (B) T2-weighted image highlighting the AVM, and (C) postcontrast image enhancing the visibility of the malformation.

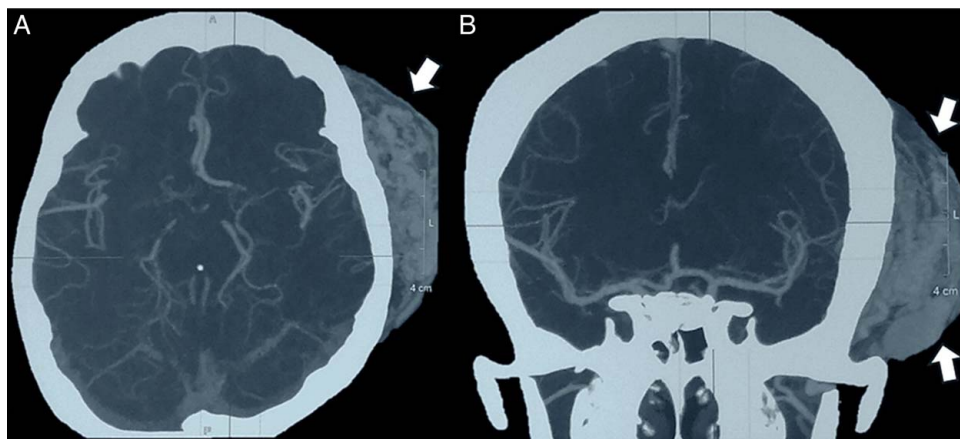


Figure 4. Computed tomography angiogram (CTA) depicting a scalp arteriovenous malformation (white arrows): (A) axial view showing dilated tortuous vascular channels and (B) coronal view confirming the extent and vascular supply of the AVM.

consider the patient's age, sex, and individual health status are crucial for achieving optimal outcomes and ensuring patient satisfaction.

Our multidisciplinary approach to managing a young female patient with a scalp AVM emphasizes the importance of timely diagnosis. The clinical presentation of scalp AVMs varies widely, from asymptomatic cases to those presenting with pulsatile masses, pain, and bleeding^[3,7]. Hence, a high index of suspicion is necessary, and diagnostic imaging plays a pivotal role in confirming the diagnosis^[1,2]. In our case, the patient presented after her condition had evolved, and symptoms were clearer. Nonetheless, diagnostic imaging approaches, including angiography and MRI, facilitated a comprehensive assessment of the AVM's size, location, and vascular anatomy.

Embolization, as an initial therapeutic step, has become a mainstay in managing scalp AVMs^[2]. This minimally invasive technique allows for the reduction of blood flow within the AVM nidus, thereby mitigating the risk of bleeding and preparing the lesion for surgical resection^[2]. Endovascular embolization was safely and successfully performed in our case, resulting in a significant reduction in AVM size and vascularity, which facilitated subsequent surgical intervention.

Surgical resection remains a crucial component of the treatment plan for many scalp AVMs^[4]. The surgical team approached the AVM resection meticulously, taking into consideration the patient's age, aesthetic concerns, and the complex vascular network^[8–15]. The goal was to achieve complete AVM removal while minimizing scarring and preserving the patient's hairline and overall appearance.

Postoperative monitoring is crucial for detecting wound infections and potential recurrence of the AVM. Follow-up includes regular clinical examinations and Doppler ultrasonography to ensure early detection of any complications. Further research is necessary to improve the understanding and management of AVMs.

The outcome of our case was favorable, with a complete resolution of symptoms and significant improvement in the patient's appearance. The comprehensive approach taken, combining endovascular and surgical techniques, provided an effective solution for this challenging condition.

Conclusions

Our case report demonstrates the effective management of a scalp AVM in a young female through a comprehensive and multidisciplinary approach. Early diagnosis and advanced imaging were crucial in guiding treatment. The combination of endovascular embolization and surgical resection led to complete symptom resolution and significant aesthetic improvement.

Regular postoperative monitoring, including clinical exams and Doppler ultrasonography, is essential to detect complications and ensure long-term success. This case highlights the importance of a patient-centric, multidisciplinary strategy for optimal outcomes in managing scalp AVMs.

Future research should focus on understanding the genetic and molecular mechanisms of AVMs, exploring less invasive treatments, and enhancing long-term monitoring strategies. This will improve management protocols and patient outcomes for those affected by this complex condition.

Ethical approval

Not required because this is a case report.

Consent

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Not applicable.

Author contribution

M.P., S.M., and G.S.: conceptualization, data curation, and methodology; S.M. and G.S.: investigation, methodology, and resources; S.C., G.E.U., G.S., and B.C.: supervision, validation, visualization, and writing – review and editing.

Conflicts of interest disclosure

There are no conflicts of interest.

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Data sharing is not applicable – no new data is generated, or the article describes entirely theoretical research.

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