

Arteriovenous Malformation of the Scalp : Efficacy of Computed Tomography Angiography

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We report a rare case of scalp arteriovenous malformation(AVM). A 55-year-old woman presented with a pulsatile palpable mass on her left temporo-parietal scalp. She complained of insomnia because of bruit, which was audible when she lay on her left side. Computed tomography angiography(CTA) for the scalp vessel showed AVM on the left temporo-parietal region. Multiple enlarged arteries, such as the superficial temporal artery, posterior auricular artery, and occipital artery, were directly connected to the elongated dilated superficial temporal vein. Digital subtraction angiography also showed similar results. Fistulous portions were clearly delineated on both modalities. Surgical excision of the malformations, including feeding arteries and the draining vein, resulted in immediate relief of the symptoms. Usefulness of CTA in the diagnosis of vascular lesions on the scalp was emphasized.

KEY WORDS : Scalp AVM · CT angiography.

Introduction

Arteriovenous malformation(AVM) of the scalp is a rare lesion that results from an abnormal arteriovenous communication, which lies within the fatty layer of the scalp⁵⁾.

It is difficult to manage because of its complex vascular anatomy, high shunt flow, and cosmetic disfigurement⁹⁾. A pulsatile disfiguring scalp mass with thrill is the most frequent clinical presentation, although bleeding and scalp necrosis can also occur¹⁰⁾. Catheter angiography on the external and internal carotid artery(ECA and ICA) has been known to be a gold standard for the diagnosis of scalp AVM. However, with recent advances in multichannel spiral computed tomography(CT) and reconstruction software, computed tomography angiography(CTA) has been performed more frequently for the diagnosis of various intracranial

vascular diseases, thus reducing the chance of angiography complications¹⁵⁾. There have been few reports regarding the usefulness of CTA for evaluating the patency of EC-IC bypass grafts, and their usefulness in the diagnosis of scalp AVM has not yet been reported. We report a case of scalp AVM that was diagnosed with CTA and was successfully treated surgically.

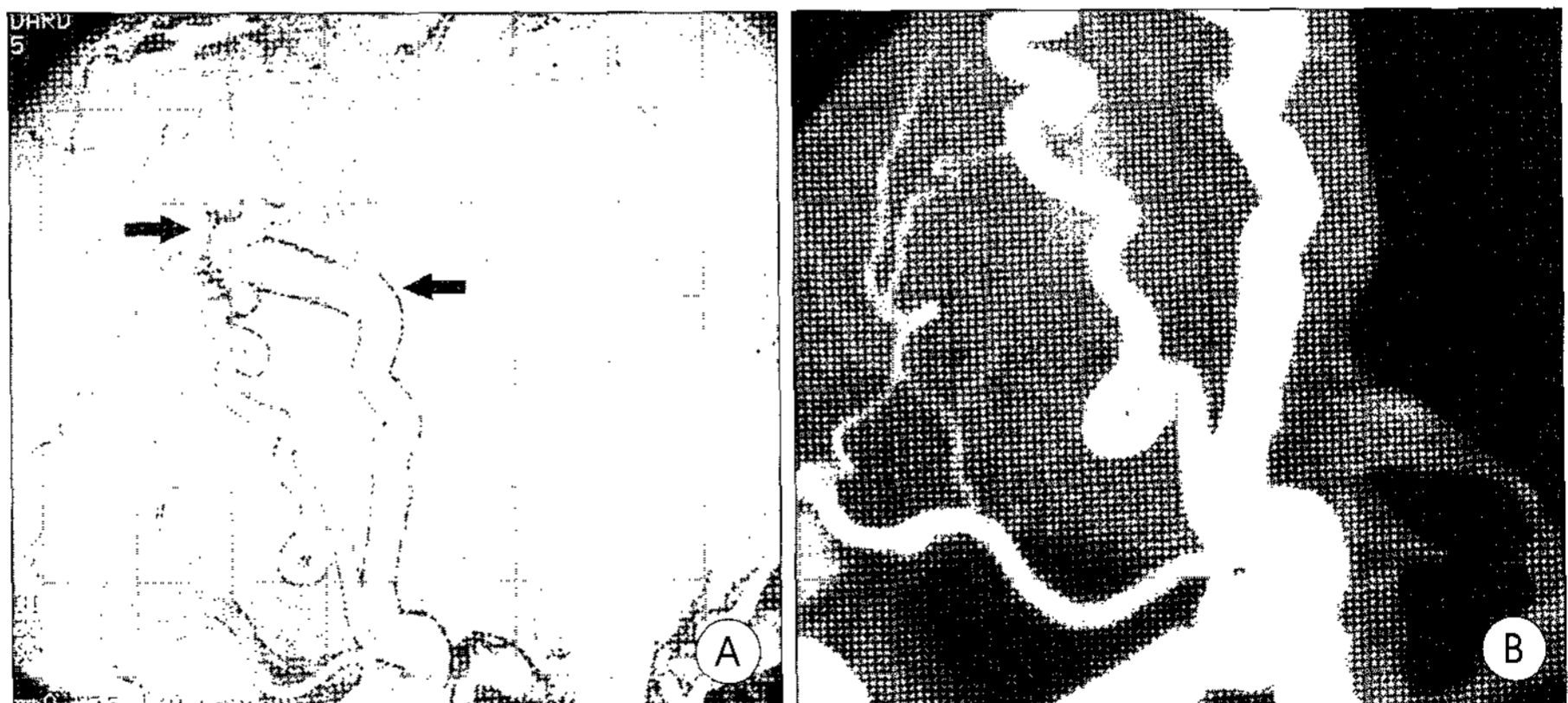


Fig. 1. Computed tomography angiography showing a scalp arteriovenous malformation between multiple feeding arteries, such as the superficial temporal artery, posterior auricular artery, and occipital artery. It also shows a marked, dilated superficial temporal vein overlying the outer surface of skull bone. Arrows indicate multiple fistulous portions (A). Maximal intensity projection image (B) also shows prominent tortuous superficial temporal artery and marked dilated superficial temporal vein.

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Case Report

A 55-year-old woman was admitted with a pulsatile palpable mass in her left temporoparietal scalp. She did not complain of headache. Progressive enlargement of pulsatile mass made her nervous over time. And she could not sleep well because of bruit, which was audible when she lay on her left side. Physical examination showed a serpentine irregular pulsatile mass in her left temporoparietal scalp with thrill. It was 4 × 5 cm in size. It was soft, and had no tenderness. She had no history of trauma. The general and neurological examinations were normal, except for the mass. The plain skull X-ray was normal. Pre- and post-contrast CT scans showed a well enhanced extracranial mass in the subcutaneous region of the left temporoparietal scalp. Intracranial abnormality was not detected. CTA showed AVM of the scalp in the left

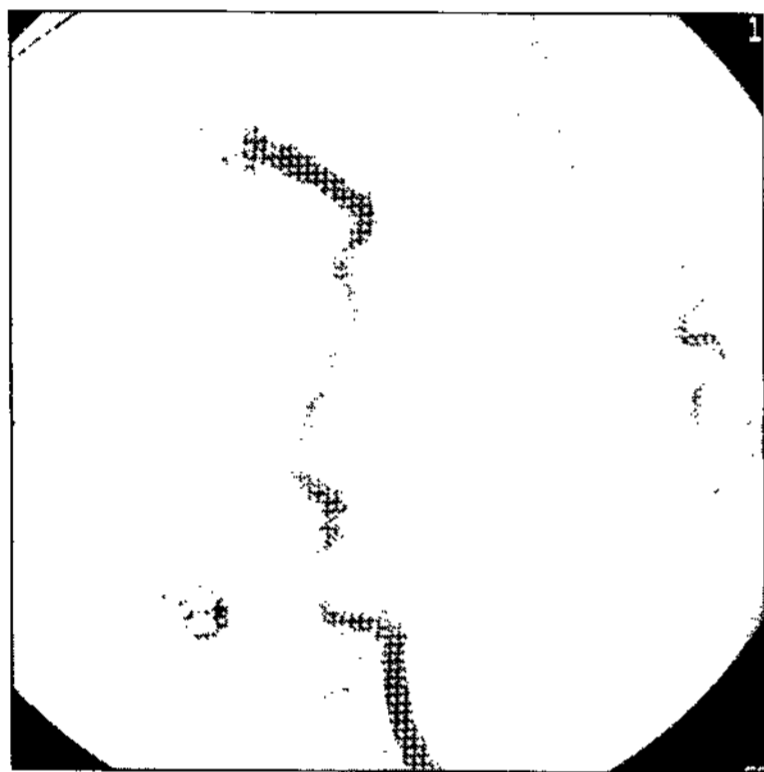


Fig. 2. Digital subtraction angiography of the left external carotid artery showing a tortuous, elongated, prominent, superficial temporal artery and the occipital artery contributing to fistulous flow draining into the superficial temporal vein. The finding is comparable to computed tomography angiography.



Fig. 3. Pathologic finding showing a thickened arterial wall, which only differs from a normal artery in thickness. (H&E, x40).

temporoparietal region. Multiple enlarged arteries, such as the superficial temporal artery, posterior auricular artery and occipital artery, were directly connected to the elongated dilated superficial temporal vein (Fig. 1). DSA for ECA showed similar results (Fig. 2). There was no evidence of communication with intracranial circulation.

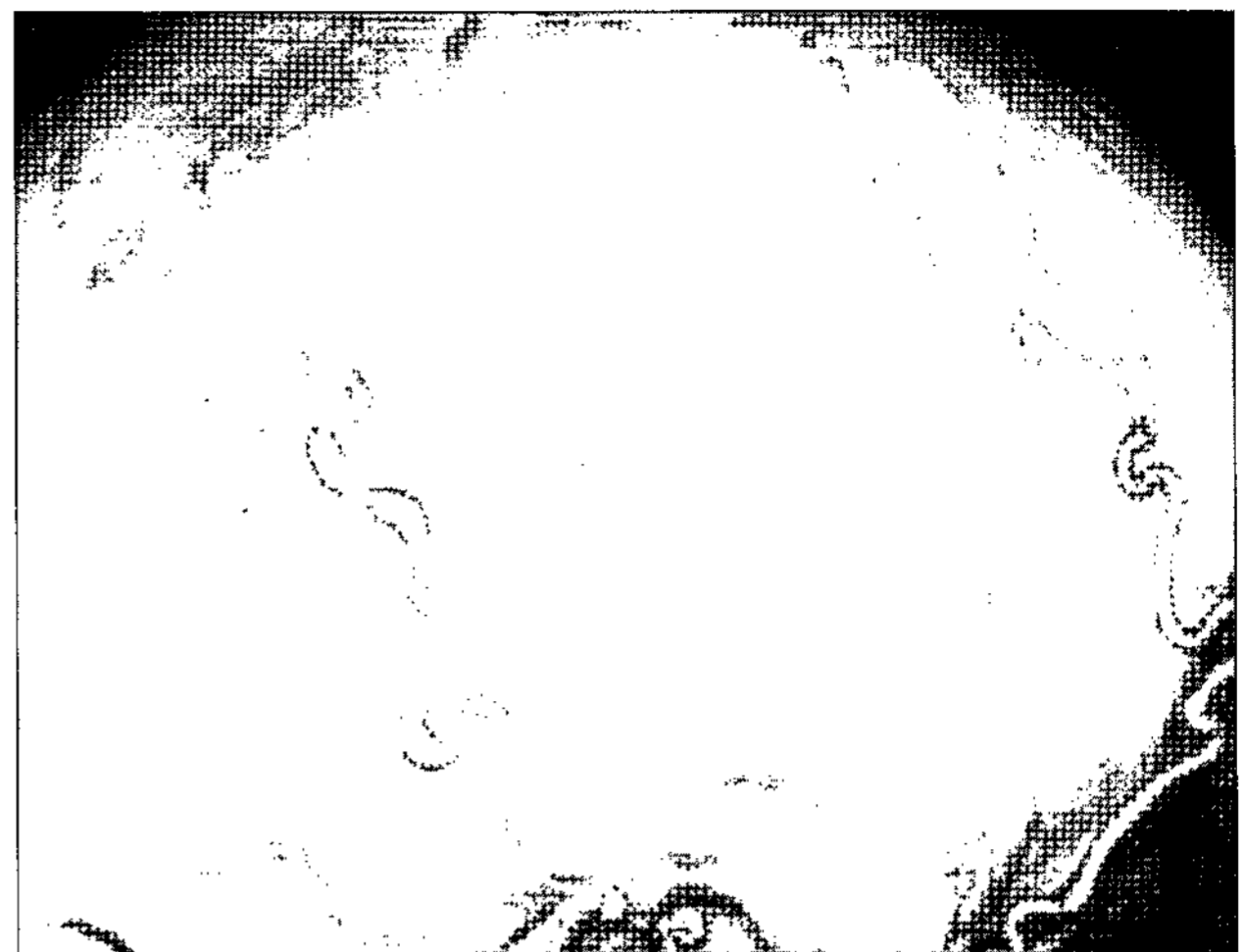


Fig. 4. Postoperative computed tomography angiography showing complete disappearance of the arteriovenous malformation of the scalp.

Surgical excision was performed using a curvilinear skin incision around the scalp AVM. Exposure and ligation of the superficial temporal artery was performed first near the fistula so that the scalp flap could be raised without excessive bleeding. Complete excision of AVM, including the feeding artery and draining vein, was done without difficulty. Histological examination showed the dilated artery and vein consistent with AVM (Fig. 3). Postoperatively, she had an uneventful recovery without scalp necrosis. Postoperative CTA demonstrated a complete disappearance of scalp AVM without any remnants (Fig. 4).

Discussion

Scalp AVM is a rare lesion that results from an abnormal arteriovenous communication, usually within the subcutaneous fatty layer of the scalp⁵. The feeding artery is derived from vessels that normally supply the scalp. The AVM of the scalp usually drains into abnormal, dilated scalp or facial veins, and is thus responsible for cosmetic defects of varying severity. The origin of AVM of the scalp is still uncertain, but as many as 38% may be related to trauma^{5,11}. Iatrogenic cases after hair transplantation and even craniotomy also have been documented.

Khodadad³, in a review of 148 cases of AVM of the scalp, noted that 55% were thought to be congenital and about one half of those patients had red or purple birthmarks. Schechter and Gutstein¹³ reported 23 cases of AVM of the scalp, all of which were traumatic in origin. Clinical manifestations of scalp AVM were pulsation, tinnitus, headache, bleeding tendency, skin erosion, and occasionally cosmetic or functional problems^{1,4-7,16}. AVM of the scalp sometimes causes neurologic abnormality. Mohanty and Rao⁸ described

a patient whose epilepsy and mental retardation were associated with scalp AVM. Ohno, et al.¹²⁾, reported intracranial ischemia in a case of scalp AVM due to the blood steal phenomenon. Intracranial pressure may increase if high pressure draining veins flow into the jugular vein.

The cause of AVM growth is not due to cellular proliferation of typical tumors, but to the angioectatic action maintained by the hemodynamic conditions at the level of the malformation. The natural course of AVM is relentless progression, but spontaneous regression is rare. The complications of untreated AVM are potentially too serious to permit conservative management. These complications include excessive bleeding, scalp necrosis, heart failure, disfigurement, endarteritis with septicemia, and abnormal limb growth^{1,2,14)}.

In planning the operative procedures, the feeding arteries should be identified by arteriogram and ligated before exposing the arteriovenous mass. Total excision of the extracranial malformation demands a complete knowledge of the feeding artery, the draining vein and nidus of AVM. Thus, selective external and internal carotid angiographic studies or CTA should be performed. DSA, on the other hand, is an invasive, time and cost intensive technique, requiring arterial puncture and high skills for intra-arterial manipulation of catheters. In addition, DSA carries a well defined morbidity related to neck vessel dissection and intracranial thromboembolic complications, as well as femoral artery trauma.

Recent developments of CT scanners with multi-slice technology provided significant improvements in vascular applications. Advantages of CTA include shorter acquisition times, retrospective creation of thinner or thicker sections from the same raw data, improved 3D rendering with diminished artifacts, and decreased contrast dosage. CTA can provide a very high temporal resolution and the visualization of the relation with adjacent bony structures, which may be important in surgery planning¹⁵⁾. Even though CTA has some drawbacks, such as the use of contrast material and the lack of information about blood flow direction, it can be used as a diagnostic alternative for extracranial and intracranial vascular diseases.

Conclusion

A case of scalp AVM is presented. An accurate preoperative angiographic study is necessary to delineate the fistulous

portion and its afferent and efferent vessels. In addition to DSA, CTA enables excellent visualization of the fistulas and their vascular connections. CTA can also be used as an alternative to DSA for the diagnosis of extracranial vascular diseases, such as scalp AVM.

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