Treatment of a Scalp Arteriovenous Malformation by a Combination of Embolization and Surgical Removal

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Summary

The authors describe a 21-year-old man in whom a large arteriovenous malformation of the scalp was eliminated using a combined interventional, neuroradiological and neurosurgical approach. Embolization was utilized to reduce arterial blood supply to the malformation. Eudragit-E, as a liquid embolic material from a cationic polymer, methyl and butyl methacrylate, and dimethylaminoethyl methacrylate copolymer, was injected through the transarterial route and then by direct percutaneous puncture of the nidus. One week after embolization, the nidus was easily resected with minimal blood loss. A postoperative angiogram showed nearly total extirpation of the nidus as well as complete clinical recovery. Preoperative embolization in this case was a safe and effective ablative technique.

Introduction

Scalp arteriovenous malformation (Scalp AVM) is a rare lesion most often occurring spontaneously or after trauma¹⁻³. The clinical manifestation may be symptoms of a pulsating mass, headache, local pain, bruits, tinnitus, and thrill. It is a difficult lesion to manage due to the rich collateral pathway. The authors report

a case in which a large AVM of the scalp was eliminated using a combined interventional, neuroradiological and neurosurgical approach.

Case Report

A 21-year-old man presented with a large, disfiguring, pulsatile scalp mass at the temporal region. Four years earlier he received a biopsy for the small subcutaneous mass by a plastic surgeon. The histological diagnosis was vascular malformation. The mass gradually increased in size and the patient was progressively bothered by loud bruit.

Examination

Physical examination revealed a 6 cm x 6 cm pulsatile scalp mass (figure 1). It was quite firm. A loud bruit was auscultated. Both superficial temporal arteries were tortuous and prominent. A large, dilated vein drained the mass and extended down over the scalp. There was no evidence of congestive heart failure. The remainder of the physical examination was normal.

Selective angiography confirmed the presence of an AVM of the scalp, which was supplied primarily by enormous branches of the

Figure 1 Photograph of the pulsatile scalp mass in the right temporal region. A draining vein can also be seen.

right external carotid artery and ophthalmic artery. The left external carotid artery also participated through an arterioarterial network that crossed the midline (figure 2). It was difficult to delineate the lesion due to the rich collateral pathways.

Treatment

On June 15, 2001, treatment was performed with transarterial embolization. After the induction of general anesthesia, the patient underwent right femoral artery catheterization in the angiographic suit. A 6 F guiding catheter was used to selectively cannulate the right external carotid artery. Transarterial embolization was conducted for four branches of the external carotid artery (posterior auricular artery, occipital artery, superficial temporal artery, middle deep temporal artery) using a flow directed microcatheter (Balt Magic 1.5 F). Following an injection of 70% ethanol, which has the property of preventing precipitation in the microcatheter than the embolic agent alone, an

Figure 2 A-C) Right external carotid angiogram, lateral projection, showing AVM supplied by enormous branches of right external carotid arteries. The draining vein was the dilated scalp vein. D): Right internal carotid angiogram, lateral projection, revealing the dilated ophthalmic artery supplying AVM. E): Contralateral external carotid arteriogram, frontal view. Recruitment of contralateral superficial temporal arteries to supply the nidus.

injection of 13% Eudragit-E was given to each (0.7-2.4 ml). Subsequently, a direct percutaneous puncture of the nidus using 21 gauge butterfly needle was performed (figure 3). Minimal bleeding occurred back through the needle. 13% Eudragit-E, 0.7 ml, was injected with compression of the venous outflow resulting in stagnation of the shunt flow. *In all settings, the Eudragit-E reached the nidus components.* Although angiography showed the persistence of circulation, flow within the malformation appeared markedly slowed, the nidus became firm and the pulsations vanished. Two weeks later, direct percutaneous puncture of the nidus was performed under local anesthesia. Four injections, each at different position, with compression of the venous outflow, of 13% Eudragit-E (1.0-1.8ml) partially occluded the nidus. A follow-up angiogram taken one week after the second embolization, right common carotid injection, showed the reduction of the arteriovenous malformation (figure 4). The patient retained a large nonpulsatile scalp mass with no evidence of necrosis. On July 10, 2001, the pa-

Figure 3 Direct puncture of the nidus, performed with a 21 gauge butterfly needle with the occlusion of venous outflow.

Figure 4 Follow-up arteriogram taken 1 week after the 2nd embolization, right common carotid injection, showing the reduction of the AVM.

Figure 5 Follow-up arteriogram taken 1 week after surgery, right common carotid injection, showing nearly total exclusion of the AVM.

Figure 6 Photograph after surgical extirpation. Reduction of the large mass and disappearance of the dilated draining vein were noted.

tient underwent excision of the unsightly hard mass with minimal blood loss. The nidus was sited between the galea and the temporal fascia, which was clearly undermined, and the scalp was then closed in a single layer. The pa-

tient's postoperative course was smooth and included no cutaneous problems. A follow-up arteriogram at one week showed *nearly total* disappearance of the AVM (figure 5). Although minimum shunt has been remained, the patient recovered completely from his symptoms and showed normalization of his facial expression (figure 6).

Discussion

It is well known that the only effective method of preventing evolution of AVM of the scalp is to exclude the lesion completely from the circulation⁴. Untreated patients develop progressive scalp and facial deformity that is usually not life-threatening, but can cause significant esthetic and social disturbances^{2,5}. Management of AVMs of the head and neck includes observation, ligation of the feeding arteries, embolization, surgical resection^{1,2,6,7} or a combination of these^{8,9}. Embolization has become more common, using transarterial or transvenous methods, or by direct percutaneous approach to the lesion^{5,8,10-12}. As it is often difficult to cure scalp AVM solely with embolization, surgical resection is usually required^{8,12}. In the present case, transarterial embolization was performed first to slow the blood flow, minimizing the chance of haemor-

rhage and preventing inadvertent washout into the venous outflow tract during subsequent direct percutaneous puncture of the nidus. The decreased inflow, supported by manual compression, allowed more controlled deposition of the glue in the nidus. As excessive venous occlusion prior to thrombosis of the nidus can result in uncontrolled haemorrhage, the commonly used embolic material for AVMs of the scalp are N-butyl-2-cyanoacrylate as liquid and polyvinyl alcohol particles, silk sutures, and

minicoils. We chose Eudragit-E as the embolic material, because of its controllability and properties of thrombogenic activity¹³. We observed no local complications, such as significant pain or inflammatory reaction in this patient. *Although the follow-up period is short*, presurgical embolization combined with transarterial route and direct percutaneous puncture using Eudragit-E is a less invasive and effective way to reduce intraoperative blood loss, and facilitates surgical excision.

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