

Necrosis of the Scalp and Visual Disturbance after Embolization and Surgery for Meningioma — A Case Report —

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ABSTRACT. A case of ischemic necrosis of the frontoparietal scalp and loss of vision of the right eye after embolization and surgery for a large convexity meningioma is reported. The cause and prevention of these serious complications are discussed.

Key words: meningioma — embolization — scalp necrosis — blindness

CASE

This 48-year-old woman complained of progressively increasing numbness and weakness of the left extremities of about one year's duration. She had a generalized convulsion on June 29 and was admitted to our hospital on July 11, 1990.

General physical and cranial nerve examinations were normal, and the patient was alert and well oriented. She had mild left hemiparesis and a left hemisensory disturbance. Computed tomographic scans revealed a large enhanced mass with perifocal edema in the right frontal lobe (Fig. 1). Magnetic resonance images showed that the tumor had invaded the skull without involving the falx and sinus (Fig. 2). Digital subtraction angiography (DSA) disclosed prominent tumor vascularities receiving arterial supply from the branches of middle meningeal artery on both sides (Fig. 3). These radiologic findings were considered to be diagnostic of a convexity meningioma.

Following DSA, selective embolization was done with the tip of the catheter in the left middle meningeal artery, using polyvinyl alcohol (Ivalon) particles. These were injected slowly through the catheter into the artery under fluoroscopic control. Following this procedure, the right external carotid artery was catheterized, but the catheter tip could not be positioned in the middle meningeal artery. Therefore, it was positioned just below the origin of the superficial temporal artery, and Ivalon particles were slowly injected under the manual compression of the superficial temporal artery. Postembolization DSA revealed complete devascularization of the tumor (Fig. 4).

Two days after this embolization, the patient underwent a right frontoparietal craniotomy with a U-shaped scalp incision. The base of the scalp flap (i.e., the distance between both ends of the incision) was 11 cm in length and



Fig. 1. Enhanced computed tomographic scans showing a large mass with perifocal edema in the right frontal lobe.

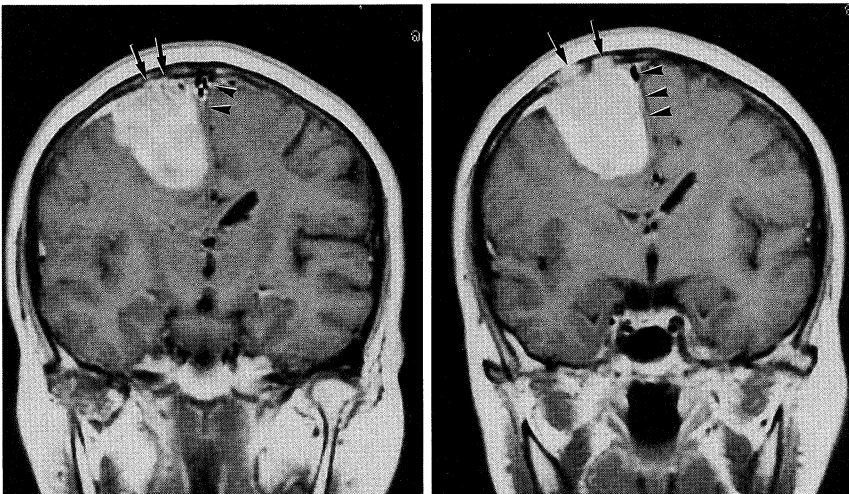


Fig. 2. Gd-DTPA enhanced T_1 -weighted coronal images (TR: 400 ms, TE: 15 ms) show the tumor invading the skull (arrows). The tumor is extremely close to the falx and the superior sagittal sinus (arrowheads).

the height (measured on a line perpendicular to the baseline) was 8 cm. The tumor was totally removed with no blood transfusion and with no postoperative neurological deficits.

On the third postoperative day, the frontal and superior edges of the scalp were found to have a dusky appearance. On the seventh postoperative day, the patient complained of disturbance of visual acuity in the right eye. As the edges of the scalp became completely necrotic after one month (Fig. 5), the lesion was successfully managed by free tissue transfer and a galea flap transfer.

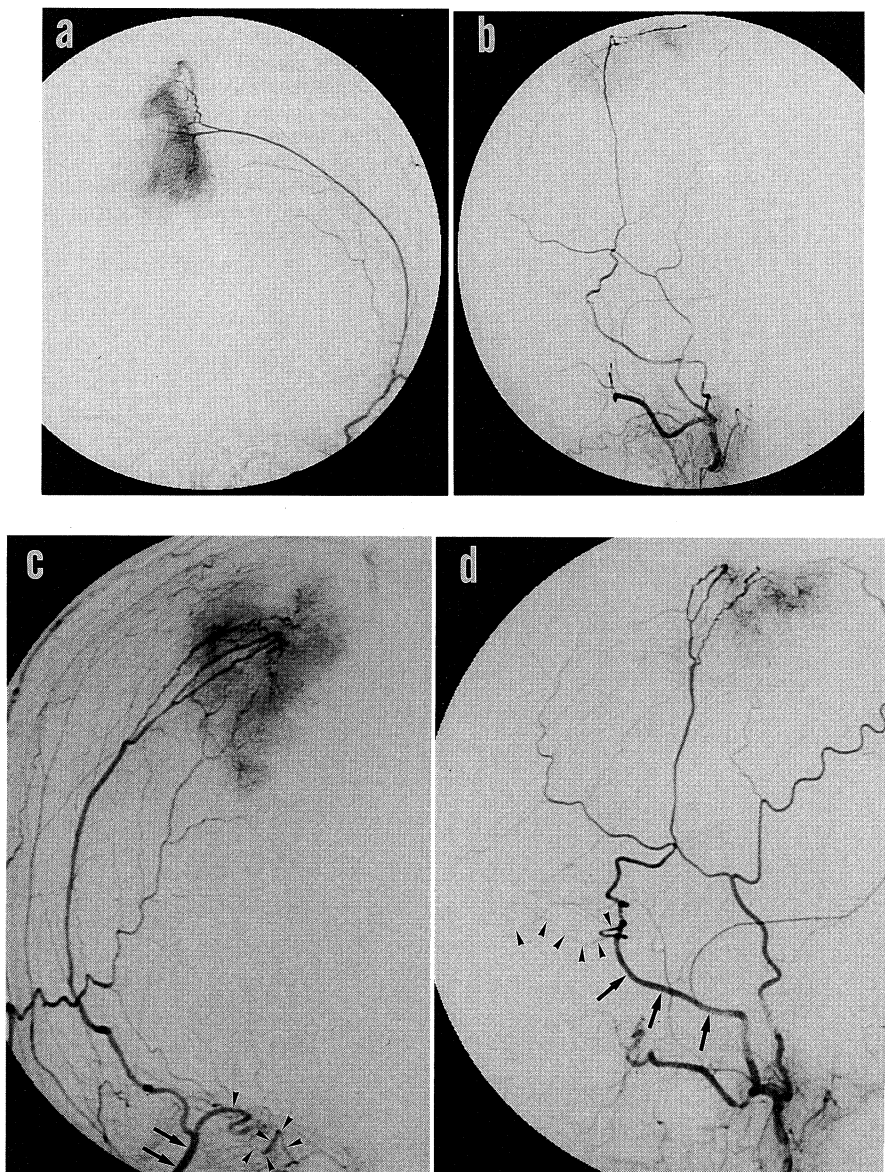


Fig. 3. AP(a) and lateral(b) projections of a left external carotid angiogram, and AP(c) and lateral(d) projections of a right external carotid angiogram showing prominent tumor vascularities receiving arterial supply from the bilateral middle meningeal arteries. The right ophthalmic artery (arrowheads) is supplied by the right middle meningeal artery (arrows).

DISCUSSION

The objective of preoperative embolization of intracranial meningiomas is to aid surgical excision by reducing tumor vascularity, thereby decreasing loss

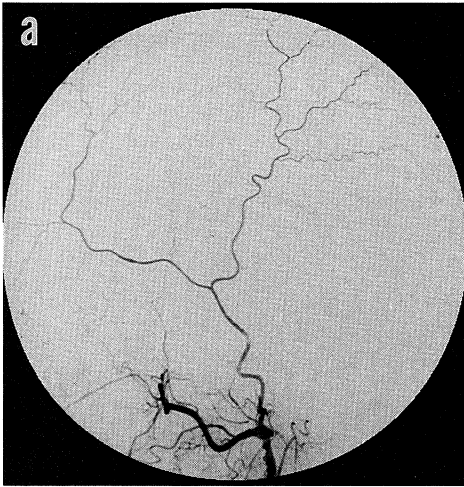
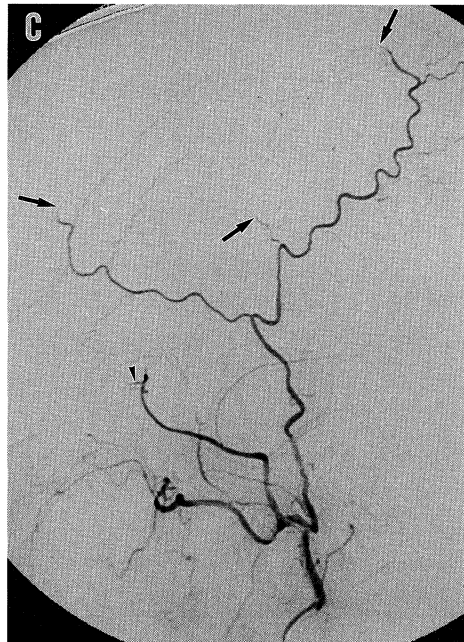
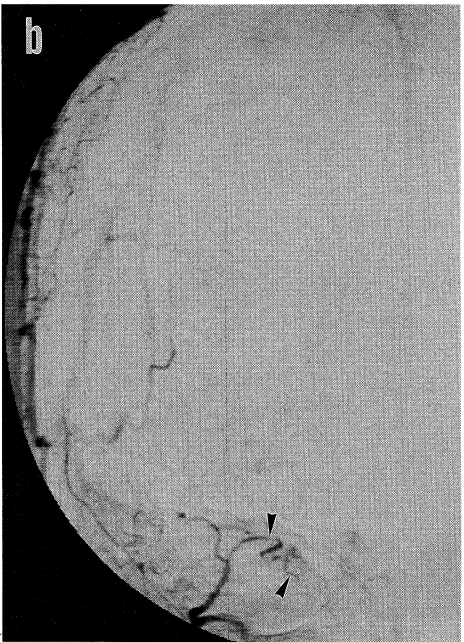


Fig. 4. Lateral(a) projection of a left external carotid angiogram, and AP(b) and lateral(c) projections of a right external carotid angiogram after embolization reveal complete devascularization of the tumor. The peripheries of the right superficial temporal artery have been embolized (arrows) and poor circulation of the right ophthalmic artery can be seen (arrowheads).



of blood during the operation. Preoperative embolization can be considered to be a useful technique as a preparatory step to operation.¹⁻⁵⁾ However, some complications after therapeutic embolization of the external carotid arterial tree have been reported.⁶⁻¹¹⁾ Adler *et al.* described a case of ischemic necrosis of the occipital scalp following embolization and surgery for a large convexity meningioma.¹⁰⁾ He suggested that this complication could probably be avoided by modifying the surgical incision. Hence the risk of infarction in the scalp should not contraindicate preoperative embolization of large vascular meningiomas. In our case, the peripheries of the right superficial temporal

were embolized because superselective catheterization of the right middle meningeal artery could not be performed (Fig. 4). We believe that this complication can be avoided by superselective embolization.

Lasjaunias and Berenstein reported two permanent meningeal to ophthalmic embolizations with permanent blindness in 185 patients embolized for meningiomas at the beginning of their experience.¹¹⁾ They stressed that this complication was related to poor technique and disregard of extracerebral-intracerebral anastomosis. In our case, anastomosis between the right ophthalmic artery and the right middle meningeal artery was retrospectively verified (Figs. 3,4). The blood flow of the right ophthalmic artery had been reduced following the embolization, and poor circulation in the periphery of the ophthalmic artery was found. Right internal carotid angiography did not demonstrate the right ophthalmic artery. Therefore, the blood to the bed of the right ophthalmic artery was supplied only by the right middle meningeal artery. Hayreh previously described this abnormal mode of origin of the ophthalmic artery.¹²⁾ This complication, namely visual disturbance, is can be avoided by careful study of preoperative angiograms. It is important that the catheter be placed as distal as possible into a feeding artery to avoid overembolization and reflux of the emboli into other arterial channels.

We used polyvinyl alcohol (Ivalon) particles as the embolic material. Ivalon offers a number of advantages over other embolic materials, including biocompatibility, promotion of progressive thrombosis and fibrosis, permanence, compressibility, and manageability.^{13,14)}



Fig. 5. Frontoparietal scalp one month after the operation. The edges of the scalp flap are completely necrotic.

REFERENCES

- 1) Djindjian, R., Cophignon, J., Théron, J., Merland, J.J. and Houdart, R. : Embolization by superselective arteriography from the femoral route in neuroradiology — Review of 60 cases. *Neuroradiology* **6** : 20-26, 1973
- 2) Djindjian, R., Cophignon, J., Rey, A., Théron, J., Merland, J.J. and Houdart, R. : Superselective arteriographic embolization by the femoral route in neuroradiology. Study of 50 cases. III. Embolization in craniocerebral pathology. *Neuroradiology* **6** : 143-152, 1973
- 3) Hilal, S.K. and Michelsen, J.W. : Therapeutic percutaneous embolization for extra-axial vascular lesions of the head, neck, and spine. *J. Neurosurg.* **43** : 275-287, 1975
- 4) Hieshima, G.B., Everhart, F.R., Mehringer, C.M., Tsai, F., Hasso, A.H., Grinnell, V.S., Pribram, H.F. and Mok, M. : Preoperative embolization of meningiomas. *Surg. Neurol.* **14** : 119-127, 1980
- 5) Richter, H.P. and Schachenmayr, W. : Preoperative embolization of intracranial meningiomas. *Neurosurgery* **13** : 261-268, 1983
- 6) Kendall, B. and Moseley, I. : Therapeutic embolization of the external carotid arterial tree. *J. Neurol. Neurosurg. Psychiatry* **40** : 937-950, 1977
- 7) Bentson, J., Rand, R., Calcaterra, T. and Lasjaunias, P. : Unexpected complications following therapeutic embolization. *Neuroradiology* **16** : 420-423, 1978
- 8) Handa, J., Nakasu, S. and Matsuda, I. : Facial nerve palsy following therapeutic embolization. *Surg. Neurol.* **14** : 377-380, 1980
- 9) Chan, R.C. and Thompson, G.B. : Ischemic necrosis of the scalp after preoperative embolization of meningeal tumors. *Neurosurgery* **15** : 76-81, 1984
- 10) Adler, J.R., Upton, J., Wallman, J. and Winston, K.R. : Management and prevention of necrosis of the scalp after embolization and surgery for meningioma. *Surg. Neurol.* **25** : 357-360, 1986
- 11) Lasjaunias, P. and Berenstein, A. : Dural and bony tumors. *In Surgical neuroangiography*. vol. 2, ed. by Lasjaunias, P. and Berenstein, A. Berlin, Springer-Verlag. 1987, pp. 57-99
- 12) Hayreh, S.S. and de Raad, R. : The ophthalmic artery. *In Radiology of the skull and brain, angiography*, vol. 2, ed. by Newton, T.H. and Potts, D.G. St. Louis, The C.V. Mosby Company. 1974, pp. 1333-1390
- 13) Tadavarthy, S.M., Moller, J.H. and Amplatz, K. : Polyvinyl alcohol (Ivalon) — A new embolic material. *Am. J. Roentgenol.* **125** : 609-616, 1975
- 14) Latchaw, R.E. and Gold, L.H.A. : Polyvinyl foam embolization of vascular and neoplastic lesions of the head, neck, and spine. *Radiology* **131** : 669-679, 1979