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Embolization of a Dural Arteriovenous Malformation Using Gianturco Coils

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A patient had a congenital dural arteriovenous malformation in the supraorbital and subfrontal regions. The malformation was successfully embolized using both a percutaneous approach with transcatheter embolization of a Gianturco coil, and a direct approach with embolization of coils through an 18 gauge needle after surgical exposure of the aneurysmal venous sac.

Case Report

A 16-year-old girl was seen by a local ophthalmologist because of diplopia and fullness of the right eye. Examination revealed visual acuity of 20/20 in both eyes with a 2–3 mm proptosis of the right eye. The right eye was also displaced downward with restriction of upward gaze and redness of the right canthus. There was a machine-like bruit over the right eye and a thrill over the right supraorbital region. The patient was admitted to the hospital for further evaluation and treatment.

Right-sided selective internal and external angiography revealed a dural arteriovenous malformation in the supraorbital and subfrontal regions. The major feeding arteries were the middle deep temporal and middle meningeal arteries from the internal maxillary artery and, a lesser contribution, the ethmoidal meningeal artery from a branch of the ophthalmic artery (fig. 1).

Because the external carotid artery was the major feeding artery of the large dural arteriovenous malformation, superselective catheterization was done and a 3 mm mini Gianturco coil was introduced through a size 5 French catheter. Postembolization external carotid arteriography revealed a complete occlusion of the middle meningeal artery as well as the distal part of the internal maxillary artery (fig. 2A). A postembolization selective internal carotid arteriogram revealed filling of the aneurysmal dilated venous sac from the ethmoidal branch of the ophthalmic artery. Physical examination at that time revealed a decreased orbital bruit and improvement of the diplopia.

Five days later, a frontotemporal craniotomy was performed and the residual dural arteriovenous malformation was exposed. An 18 gauge needle was directly inserted into the aneurysmal venous sac and 8 mm Gianturco coils were introduced. After this, the medium (5 mm) and mini (3 mm) coils were injected. A total of 18 coils were introduced until there was no blood return through the needle. The craniotomy was closed and the postoperative course was uneventful. Postoperative arteriography revealed the dural arteriovenous malformation (AVM) to be completely occluded by the coils in the supraorbital and subfrontal regions (fig. 2B). The patient was completely asymptomatic with no orbital bruits. One month later the patient remained asymptomatic with normal vision and no diplopia.

Discussion

Interventional radiology has become increasingly important in the past decade as newer or less traumatic methods of therapy are developed for various diseases. The first neurologic embolization was performed by Brooks in 1930 when he embo lized a posttraumatic carotid-carotid fistula with a muscle embolus [1]. Since that time other conditions such as AVMs, aneurysms, intractable epistaxis, and vascular tumors of the head and neck have proved to be amendable to embolization [2–19].

The ideal transcatheter embolization material should be nonantigenic, noninflammatory, noncarcinogenic, easily introduced, and permanent. Autologous clots, muscle embolus, and gelfoam are not permanent agents [19, 20]. Silicone spheres, Ivalon, isobutyl-2-cyanoacrylate and Gianturco coils are permanent agents [2–12, 21, 22]. In this case, Gianturco coils were used for the treatment. Although extracranial meningeal branches were embolized by the catheter technique, the ethmoidal meningeal branches of the ophthalmic artery could not be embolized. The large venous sac could also not be catheterized and embolized because the blood flow in the large ophthalmic vein would carry embolic material to the heart and result in a pulmonary embolism. A detachable balloon [16–18] might be considered for occlusion of the meningeal arteries, but was not thought to be suitable for this patient. Surgical removal of the AVM was not considered appropriate in this case because of a large venous drainage through the ophthalmic vein.

Considerable experience in embolization of vascular lesions with Gianturco coils in extracranial locations has been reported [23–26]. In our case of a large dural AVM, a combined catheter and direct approach using the coils was used. As a first step, medium and small branches of the extracranial meningeal arteries were occluded. The second step was a direct exposure of the venous sac and direct

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Fig. 1.—Lateral view arteriograms. A, External carotid artery. Dural arteriovenous malformation (AVM) fed by middle meningeal artery (arrows) and middle deep temporal artery (arrowheads). B, Superselective view of middle deep temporal artery. Dural AVM filled. C, Internal carotid artery. Dural AVM filled by ethmoidal meningeal artery (arrowheads) originating from ophthalmic artery.

Fig. 2.—A, Postembolization external carotid arteriogram. Lateral view. Meningeal arteries and internal maxillary artery completely occluded using single 3 mm Gianturco coil (arrows) with no filling of dural arteriovenous malformation. B, Postoperative internal carotid arteriogram. Lateral view. Aggregated coils introduced after exposure of dural venous sac. Dural arteriovenous malformation no longer fills from ethmoidal branch of ophthalmic artery.

introduction of large coils that were trapped in the malformation.

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