Transarterial Embolization With HEMA-MMA of Variant Convexity-Superior Sagittal Sinus Dural Arteriovenous Fistula
—Case Report—

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Abstract

A 62-year-old male presented with a variant dural arteriovenous fistula (DAVF) within the wall of the convexity-superior sagittal sinus, fed by branches of the bilateral external carotid arteries and only cortical venous drainage despite the presence of a patent sinus. Transarterial embolization with poly-(2-hydroxyethyl methacrylate-co-methyl methacrylate) (HEMA-MMA) was performed, resulting in complete obliteration of the DAVF. Embolization with HEMA-MMA is an effective and safe procedure for the treatment of DAVF.

Key words: dural arteriovenous fistula, embolization, superior sagittal sinus

Introduction

Dural arteriovenous fistula (DAVF) of the convexity-superior sagittal sinus account for about 7% of all DAVFs. Convexity-superior sagittal sinus DAVF presents with unique problems because of the midline location, essential venous drainage, and multiplicity of arterial feeders. The lesion is often associated with hemorrhage and dementia due to venous hypertension. Convexity-superior sagittal sinus DAVF often has only cortical venous drainage despite the presence of a patent sinus. Treatment of these fistulas is difficult. Methods include endovascular embolization, surgical interruption, radiation, and combined therapy. We described a case of variant convexity-superior sagittal sinus DAVF treated by transarterial embolization with a new liquid material, poly(2-hydroxyethyl methacrylate-co-methyl methacrylate) (HEMA-MMA).

Case Report

A 62-year-old male was admitted to our hospital in February 1997 with complaints of tinnitus and headache. Physical examination detected bruit at the right parietal region.

Magnetic resonance imaging revealed flow void due to an enlarged right parietal cortical vein. Cerebral angiography showed a convexity-superior sagittal sinus DAVF fed by the bilateral middle meningeal, superficial temporal, and occipital arteries. Venous drainage was through the right cortical vein with antegrade flow into the superior sagittal sinus and retrograde cortical flow (Fig. 1). The superior sagittal sinus was patent. This drainage pattern was consistent with the variant arteriovenous fistula within the wall of the dural sinus. Iodine-123-labeled iodoamphetamine single photon emission computed tomography showed a low perfusion area in the right parietal region.

The DAVF in this case had a cortical venous drainage and a low perfusion area, so we thought that there was a high risk of hemorrhage and neurological deficits. We treated the DAVF by transarterial embolization using HEMA-MMA. A microcatheter was introduced into the left middle
Transarterial Embolization With HEMA-MMA

Fig. 1 Right external carotid angiograms (A: anteroposterior view, B: lateral view) showing a dural arteriovenous fistula of the convexity-superior sagittal sinus fed by the middle meningeal, superficial temporal, and occipital arteries. Venous drainage is into the right cortical vein with antegrade flow into the superior sagittal sinus and retrograde cortical flow. Left external carotid angiograms (C: anteroposterior view, D: lateral view) showing a dural arteriovenous fistula.

Fig. 2 Right external carotid angiogram (A: lateral view) and left external carotid angiogram (B: lateral view) after the embolization revealing complete occlusion of the dural arteriovenous fistula.

meningeal artery adjacent to the DAVF and HEMA-MMA was injected slowly under digital subtraction angiography monitoring. Embolization was then performed for right middle meningeal artery, both occipital arteries, and both superficial temporal arteries in five different sessions. Angiography after the embolization revealed complete occlusion of the DAVF (Fig. 2).

The postoperative course was uneventful. Follow-up angiography 6 months later showed no recurrence of the DAVF.

Discussion

Selection of the treatment method for DAVF requires careful analysis of the angiographic and clinical features of the individual case. Surgical procedures for variant fistulas of the superior sagittal sinus achieve simple coagulation and division of the draining vein. Surgery is the most effective method, but is sometimes technically difficult and risky.

Recently, percutaneous transvenous coil embolization of a superior sagittal sinus DAVF is possible, but arterial embolization is straightforward, and the subsequent approach is safer. We selected transarterial embolization with HEMA-MMA.

Liquid embolization materials contain cyanoacrylates and polymer solutions. HEMA-MMA is a newly developed liquid material consisting of a copolymer of hydroxyethyl methacrylate (HEMA) and methyl methacrylate (MMA). This material is a biocompatible polymer. The conditions of polymerization of HEMA-MMA were previously described. We found that this liquid material is safe and effective for obliterating pial arteriovenous malformation and transverse-sigmoid sinus DAVF.

HEMA-MMA liquid material has a low viscosity, but is supplied as four types of solution with different viscosities, has a low risk of adhesion, and a low risk of tissue injury. Therefore, repeated injections through a microcatheter are possible. Embolization with HEMA-MMA has two problems in common with other liquid materials, recanalization and passage through the DAVF. The precipitating mass may undergo compaction as the solvent diffuses into the blood. Such compaction leads to recanalization. Therefore, the injection of HEMA-MMA should be repeated to prevent recanalization about 5 minutes.
after the cast was formed in the vessels. These procedures are performed under digital subtraction angiography monitoring. If migration into the venous drainage occurs, the procedure is stopped and another microcatheter introduced, then a higher viscosity solution is injected. Because the high viscosity solution forms a larger precipitated mass than the low viscosity solution in the blood, low viscosity solution should be selected to embolize low flow DAVF, and high viscosity solution to embolize high flow DAVF. The material does not embolize the proximal vessels of the DAVF, only the shunts, and so should occlude the DAVF. This method prevents passage of material through the lesion and consequent occlusion of venous flow.

The present case of variant convexity-superior sagittal sinus DAVF with leptomeningeal venous drainage was embolized completely without any complication. Transarterial embolization with HEMA-MMA is a safe and useful procedure for the treatment of variant convexity-superior sagittal sinus DAVF.

References


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