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Transvenous Embolization of Venous Pouch Alone for the Treatment of Cavernous Dural Arteriovenous Fistula

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Abstract

The treatment of cavernous sinus dural arteriovenous shunts (dAVS's) with multiple feeders has been a challenge to neurosurgeons. A patient was referred to our department for the treatment of the symptomatic unilateral cavernous dAVS's, which had a venous pouch within the cavernous sinus, toward which all multiple feeding arteries converge. The patient was successfully treated by the coil placement only within the venous pouch draining all shunts without any complications. Though not all cases of cavernous dAVS's have the venous pouch, a thorough and careful assessment on the pre- and intraoperative digital substraction angiography monitoring should be made to find the venous pouch or shunt point draining all shunts. Transvenous embolization of the venous pouch alone is an effective and safe method offering a higher rate of curing the shunt as well as avoiding complications associated with the complete coil packing of the entire affected sinus in the treatment of cavernous dAVS's with the venous pouch.

Key Words : Cavernous dAVS, Transvenous embolization, Venous pouch

Introduction

The treatment of cavernous dAVS's with multiple feeders has been a challenge to neurosurgeons. With advances in endovascular technique and embolic materials, transvenous embolization with using coils is now being adopted as the treatment of choice for most cavernous dAVS's [1,2].

To achieve complete cure of the shunt, many have advocated complete coil packing of the entire affected sinus including the origin of cortical draining vein as well as the actual shunt site. Although this technique is usually successful, the technique has a potential risk of cranial nerve injury due to mass effect of packed coils [2,3]. Therefore, it is necessary to occlude actual shunt site by using

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minimum coils.

The cavernous dAVS's successfully treated by the coil placement within the venous pouch draining all shunts is presented.

Case Description

A 56-year-old woman presented with a 6-month history of a right oculomotor palsy. This had been associated with episodes of right eye redness, proptosis, and diplopia secondary to cranial nerve palsy.

The angiogram revealed dAVS of the right cavernous sinus fed by branches of the right and left ascending pharyngeal artery, the right middle meningeal artery, and the right inferolateral trunk. The shunt drained into the ipsilateral superior and inferior ophthalmic vein, deep sylvian vein, vein of Labbe, and inferior petrosal sinus, also it into the opposite cavernous sinus and deep sylvian vein through the intercavernous sinus (Fig. 1).

The focal venous pouch, toward which all multiple feeding arteries converge was disclosed by a thorough and careful assessment on the DSA with rapid-sequence exposure (Fig. 2, A and B). Occlusion of the venous pouch alone was considered as the ideal method to treat the dAVS. A microcatheter was navigated into the venous pouch through the contralateral inferior petrosal sinus with accurate delineation of the anatomic arrangement on intraoperative DSA monitor and a total of five coils were put into the venous pouch alone (Fig. 2, B). Complete disappearance of all shunt was accomplished. There were no complications related to the procedure and clinical improvement occurred immediately. A complete angiogram obtained 6 months later confirmed the complete cure of the shunt (Fig. 2, C and D). The patient is now completely asymptomatic with a follow-up of 40 months.

Discussion

Several studies have investigated that the cavernous dAVS with retrograde cortical venous drainage has a potential risk of intracerebral ischemia or hemorrhage [4-9]. There is no debate that the cavernous dAVS with retrograde cortical venous drainage or presenting with cranial nerve deficits [2,6,10] indicating high-flow shunt should be treated actively. The cavernous dAVS presented here had oculomotor paralysis symptomatically or retrograde cortical venous drainage angiographycally, which prompted the therapist to manage the lesions actively and rapidly. The treatment of cavernous dAVS's fed by multiple branches has been regarded to be complicated and to treat. Various treatment modalities including intermittent carotid compression [11], direct surgery [12,13], radiosurgery [14] and transarterial [15,16] and transvenous embolization [1-3,17,18] have been proposed.

With advances in endovascular technique and embolic materials, the transvenous embolization using coils among these methods is now being accepted as the treatment of choice for most symptomatic cavernous dAVS's by many interventional neurovascular therapists [1,2]. This therapeutic approach using coils has been shown to be superior to other methods and embolic materials such as balloon, liquid adhesive, and particles, etc., in terms of effectiveness and safeness in the treatment of cavernous dAVS's with multiple feeders [1,15]. When contemplating this therapeutic approach in patients with several cortical vein drainages, many have advocated complete coil packing of the entire affected sinus including the origin of cortical draining vein as well as the actual

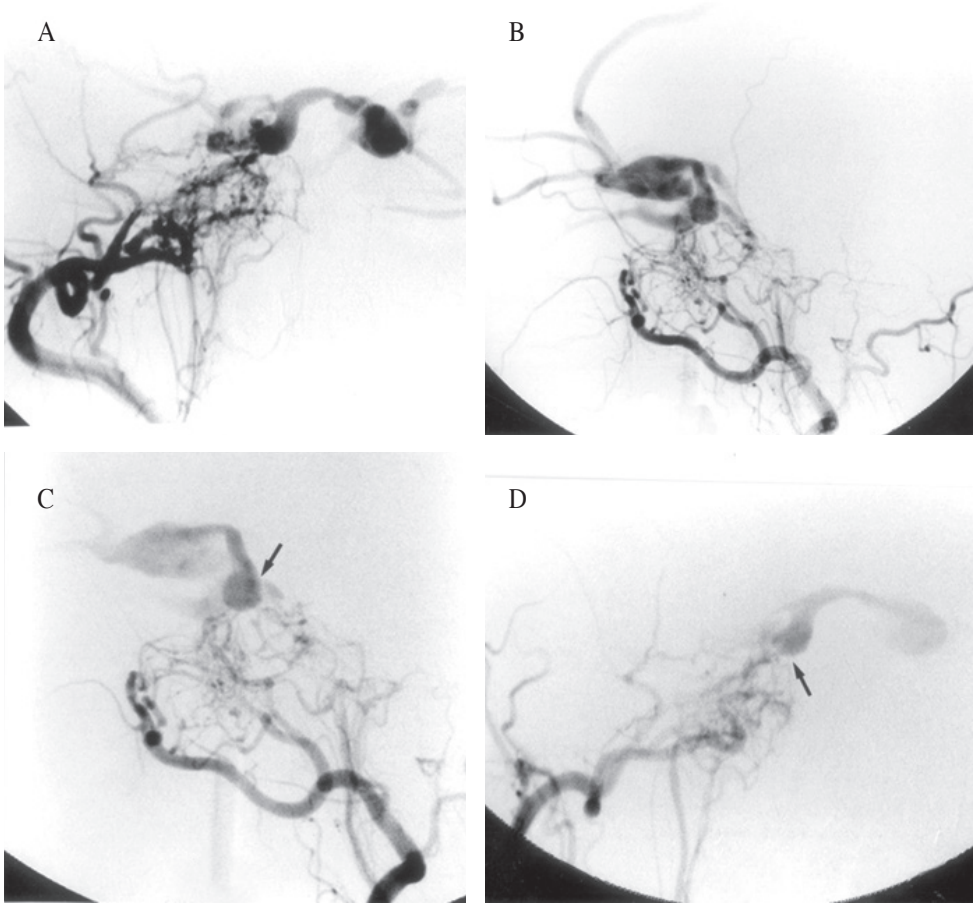

Fig. 1. Right external carotid angiograms, anteroposterior (A) and lateral (B) views, demonstrate dAVS of the cavernous sinus fed by branches of the ascending pharyngeal artery and the middle meningeal artery. The shunt drains into the ipsilateral superior and inferior ophthalmic vein, deep sylvian vein, vein of Labbe, inferior petrosal sinus, and drains into the opposite cavernous sinus through the intercavernous sinus, and deep sylvian vein. Right internal carotid and left external carotid angiograms revealed feeding arteries arising from the inferolateral trunk and ascending pharyngeal artery to the same lesion (not shown). The focal venous pouch (arrow), toward which all multiple feeding arteries converge is shown by a thorough and careful assessment on the DSA with rapid-sequence exposure (C, D).

shunt site for achieving complete cure of the shunt. Usually, this technique is performed by starting on the side of the cavernous sinus at the origin of the superior ophthalmic vein and working back toward the inferior petrosal sinus. Although this technique is usually successful, the technique has a potential risk of cranial nerve injury due to mass effect of packed coils, as reported in some literatures [2,3].

Theoretically, there may also be a risk of redirection of the flow into the remaining drainages from the occluded venous outflow eariler, leading to intracranial hypertention or aggravation of ocular symptoms. This can cause severe nausea and headache temporarily, which is frequently observed

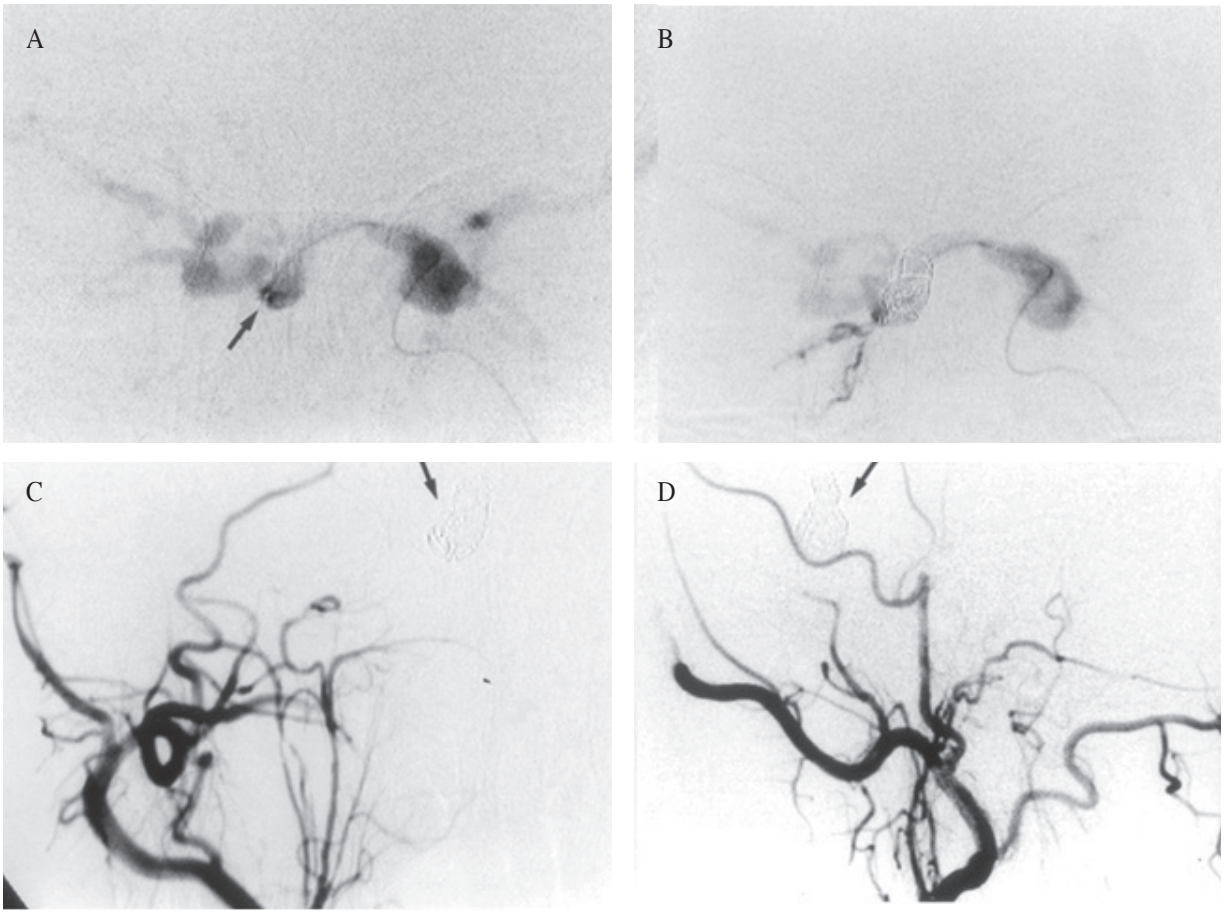

Fig. 2. Injection into the venous pouch (arrow) outlines the draining venous pathways (A). Multiple coils are being deposited within the venous pouch (B). Right external carotid angiogram, anteroposterior view (C) and left external carotid angiogram, lateral views (D), 6 months after embolization showing complete closure of shunt and the mass of coils (arrow).

during the procedure.

To avoid these complications, precise packing of the actual shunt portion by using minimum coils is necessary. Although this is an ideal method, many have not attempted this procedure. Because the coil mass deposited around the shunt often prevent the catheter from reaching the chamber close to the origin of cortical vein drainage, which can be persisted by remained shunt after placement of coils into the fistula site alone.

However, presence of a venous pouch, toward which all multiple feeding arteries converge, as observed in our cases, will offer complete obliteration of all shunt by minimal coil packing within the venous pouch alone without any fear of risk of cranial nerve palsy and without causing undesirable hemodynamic alterations in the affected sinus. To evaluate for such a focal venous pouch and delineate its anatomy, careful DSA with fast filming and multiple oblique projections should be performed. Once a drainage pouch has been identified, packing of the venous pouch alone with

coils should be attempted to achieve cure and avoid complications.

This procedure also offers economic advantages and being less time-consumptive, as compared with the complete coil packing of the entire affected sinus. A total of five coils were enough to occlude the venous pouch completely in our cases. Although this type of anatomic arrangement is uncommon in this disease, a thorough and careful assessment on the pre- and intraoperative DSA monitoring should be made to find the venous pouch or shunt point draining all shunts.

When this specific anatomic arrangement is encountered, attempts to coil venous pouch only should be considered first because of its better efficacy compared with the complete coil packing of the entire affected sinus.

Conclusion

The successfully treated cavernous dAVS by the placement of coils within the venous pouch alone, toward which all multiple feeding arteries converge is reported.

Though not all cases of cavernous dAVS's have such venous pouch, a thorough and careful assessment on the pre- and intraoperative DSA monitoring should be made to find the venous pouch draining all shunts, because it will contribute to a higher rate of curing the shunt as well as avoiding complications associated with the complete coil packing of the entire affected sinus.

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