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Case Report

Surgical Obliteration in Superior Petrosal Sinus Dural Arteriovenous Fistula

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Superior petrosal sinus (SPS) dural arteriovenous fistula (DAVF) is one of tentorial DAVFs with significant morbidity, which usually drains into the petrosal vein and its tributaries. Unless there is a connection with venous sinus, surgical obliteration is required. We present two cases of SPS DAVF which were successfully treated with the presigmoid retrolabyrinthine approach.

Key Words : Dural arteriovenous fistula · Superior petrosal sinus · Surgery.

INTRODUCTION

Tentorial dural arteriovenous fistula (DAVF) is rare but important because of significant morbidity including hemorrhage and progressive neurological deficits[1-3,8-10,13,15]. Superior petrosal sinus (SPS) DAVF is one of the tentorial DAVFs which have an almost-constant cortical drainage[6,7]. Because SPS DAVF usually drains infratentorially into petrosal vein and its tributaries[8], it frequently causes venous hypertension in the brain stem, cerebellum, or upper cervical spinal cord. Occasionally, there being no connection with a venous sinus, transvenous embolization is impossible, in which case surgical obliteration of the fistula is required. Among several possible surgical approaches, the presigmoid retrolabyrinthine approach is known as a good and safe choice where the petrosal vein is near the clivus. Herein, we report two cases of SPS DAVF successfully treated with the presigmoid retrolabyrinthine approach.

CASE REPORT

Case 1

A 35-year-old man presented with progressive quadriparesis that had developed before 5 days. MR imaging revealed an edematous lesion at the medulla oblongata and anomalous tortuous blood vessels in front of the medulla and upper cervical spinal cord (Fig. 1A). Cerebral angiography showed a DAVF at the right petrous apex fed by middle meningeal artery (MMA), accessory meningeal artery (AMA), and meningohypophyseal trunk (MHT) draining into right petrosal vein (Fig. 1B). The shunted blood flow refluxed through the right petrosal vein down to the lateral anterior pontomesencephalic, median anterior medullary, and anterior spinal veins. Because SPS was not visualized and the fistula had no connection with a venous sinus, the patient underwent transarterial embolization with low-concentration glue (n-butylcyanoacrylate) via MMA and AMA. Near-complete obliteration of the fistula was achieved with small amount of residual shunt from MHT, and the patient improved rapidly to be able to walk with a cane. On follow-up MRI 1 week after embolization, the edematous lesion and anomalous veins were almost disappeared.

Five months later, he developed sudden quadriplegia and severe respiratory difficulty. The MR imaging showed the recurrence of edema and cerebral angiography revealed increased shunt from MHT and new feeders, including ascending pharyngeal artery and recurrent meningeal branch of ophthalmic artery (Fig. 1C). Complete obliteration of the fistula was achieved by urgent transarterial embolization with glue. After embolization, respiration was improved but quadriplegia still remained. One week later, follow-up MR imaging showed no improvement of edema at the medulla and upper cervical cord, and cerebral angiography revealed development of a new shunt from the contralateral MHT. At this time, we decided to perform surgical obliter-

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ation. The fistula was successfully obliterated via presigmoid retrolabyrinthine approach (Fig. 1D, E). The dilated draining vein was coagulated and divided. One month later, DVAF was found to be completely occluded on cerebral angiography (Fig. 1F). Af-

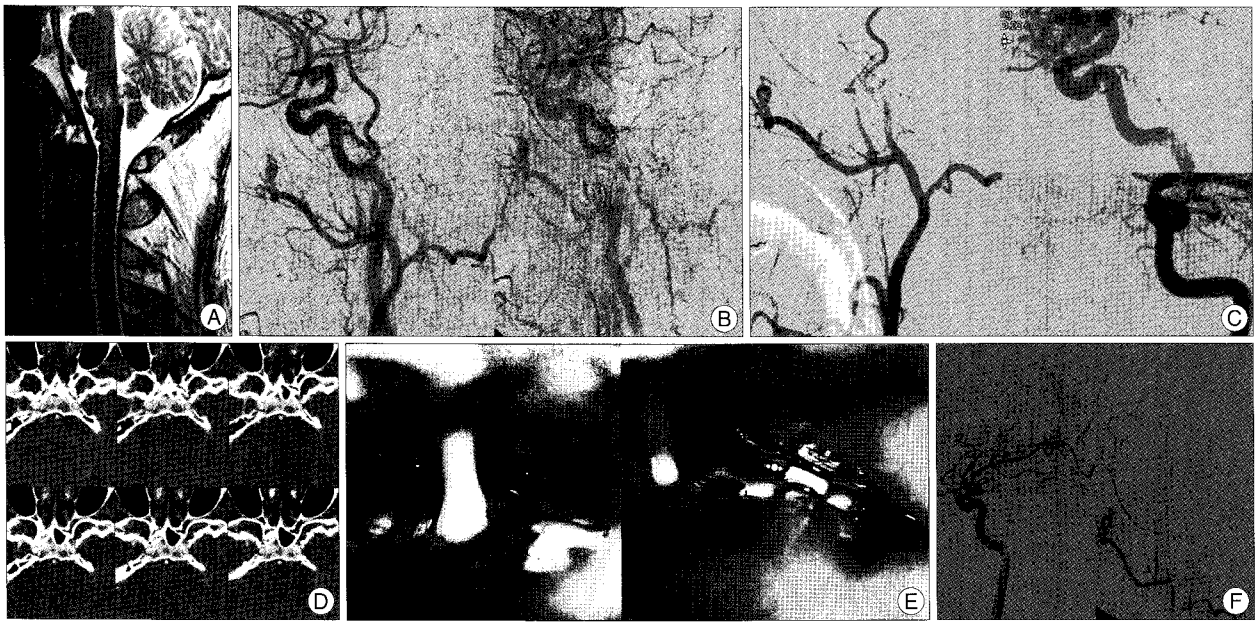

Fig. 1. Case 1. Cervical T2 weighted MR shows an edema at the medulla oblongata and anomalous tortuous blood vessels in front of brain stem and upper cervical cord (A) suggesting dural arteriovenous fistula (DAVF), which is fed by middle meningeal artery (MMA), accessory meningeal artery (AMA), and meningohypophyseal trunk (MHT) draining into right petrosal vein (B). Near complete obliteration is shown after transarterial embolization via MMA, AMA, and MHT, but small amount of shunt flow from MHT still remains. Five months after first transarterial embolization, follow-up angiography shows that the residual shunt from MHT increases and new feeders from ascending pharyngeal artery and recurrent meningeal branch of ophthalmic artery develops (C). After second transarterial embolization, shunt from contralateral MHT still remains (C). Because the petrosal vein is deep at petrous apex (D), this vein and adjacent fistula can be accessed by presigmoid retrolabyrinthine approach (E). Follow-up cerebral angiogram 1 month after surgical obliteration shows complete obliteration of DAVF (F).

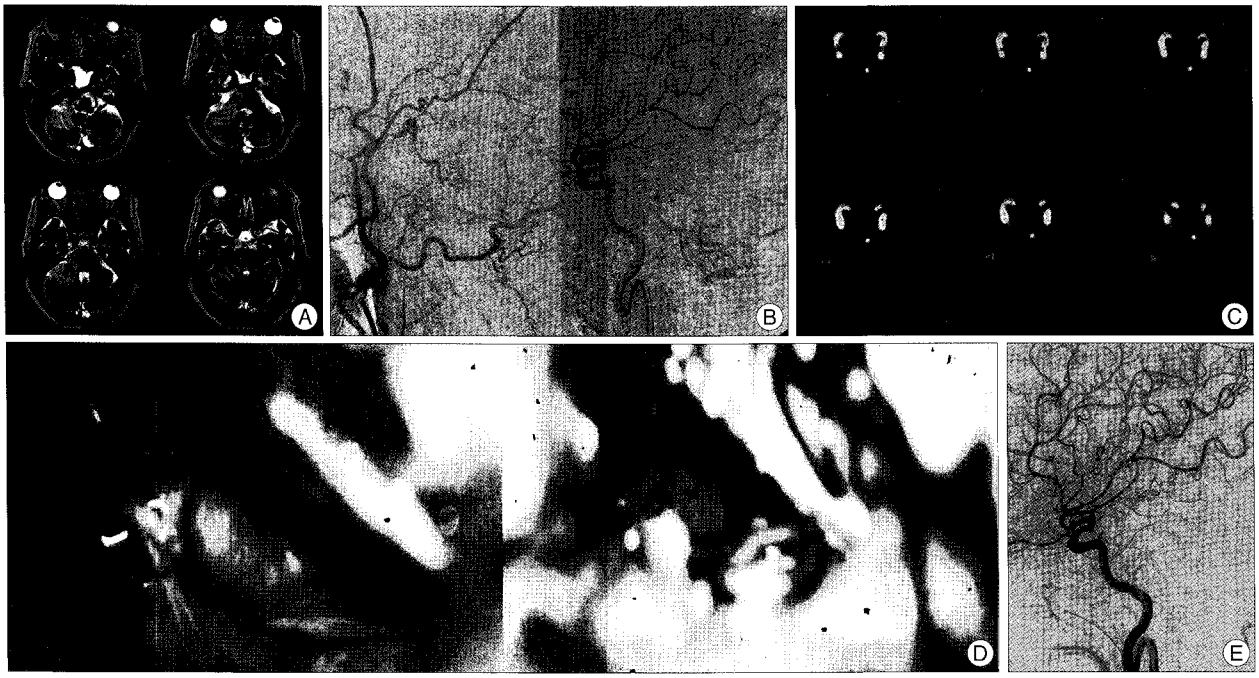

Fig. 2. Case 2. T2 axial image shows high signal intensity at right cerebellar hemisphere, pons, and midbrain suggesting venous congestion (A). Cerebral angiography reveals superior petrosal sinus DAVF fed by MMA and MHT draining into petrosal vein with reflux into the vein of the middle cerebellar peduncle (B). This fistula and petrosal vein is located at petrous ridge near apex (C) and can be successfully accessed by presigmoid retrolabyrinthine approach (D). Postoperative angiograms show complete elimination of the fistula (E). DAVF : dural arteriovenous fistula, MMA : middle meningeal artery, MHT : meningohypophyseal trunk.

ter surgery, his neurologic status improved gradually.

Case 2

A 68-year-old lady was admitted for evaluation of worsening headache, dizziness, and left-side weakness. She has taken medications for hypertension and asthma. MR imaging showed parenchymal lesions involving right cerebellar hemisphere, pons, and midbrain, with prominent vascular engorgement around them (Fig 2A). Cerebral angiography revealed a DAVF at the petrous ridge, supplied by MMA and MHT, and drained into petrosal vein with reflux into the vein of the middle cerebellar peduncle (Fig. 2B). The SPS was not visualized. Endovascular embolization via the middle meningeal artery was not successful. Presigmoid retrolabyrinthine approach was performed and the fistula at the petrous ridge could be ablated successfully (Fig. 2C, D). After coagulation and division of two veins (the pontotrigeminal vein and vein of the middle cerebellar peduncle), the remaining arterialized petrosal varix was clipped with an aneurysm clip and coagulated. Postoperative angiograms showed complete elimination of the fistula (Fig 2E). Seven days after operation her motor weakness began to improve and mild left hemiparesis still remains.

DISCUSSION

The treatment objective of DAVF is to obliterate both the fistula and the proximal draining vein as it exits the arteriovenous shunt. Endovascular embolization is an effective treatment modality, but if there is no proper venous route to access the fistula, transvenous embolization is impossible. Transarterial embolization is useful for reducing the reflux into the cortical vein, but occasionally it is not a definite treatment. In this circaumstance, open surgery should be considered in DAVF which has aggressive clinical course.

SPS DAVF is one of tentorial DAVFs with significant morbidity. Tentorial DAVF often drains into subarachnoid space via leptomeningeal veins rather than adjacent venous sinus (Borden type III)[8], where transvenous approach is impossible. This type of DAVF is fit for open surgery[4,5,12]. Obliteration of leptomeningeal vein eliminates the cortical reflux to relieve the venous hypertension and its associated symptoms, and when the residual fistula has no other outflow, thrombosis occurs in mural channels and complete obliteration of DAVF can be achieved[14]. Recent report with 31 patients treated surgically for tentorial DVAF showed that Borden type III DAVF was obliterated completely by surgical interruption of leptomeningeal vein in all cases and residual DAVF was observed in only Borden type II DAVF[8].

In case 1, although the follow-up MR imaging after 1st embolization revealed much improvement, we attempted to obliterate the DAVF via surgical approach, when the patient showed an improvement. Because the residual fistula after transarterial embolization has a high possibility of recurrence, if so, more dangerous situation could develop, considering the aggressive behavior of this type of DAVF and the changed hemodynamic after embolization. Therefore, when complete embolization is expected to be impossible or a residual fistula has remained after emergent endovascular treatment in the DAVF with aggressive nature, we strongly recommend the surgical treatment, which can obliterate completely the DAVF through simple interruption of the draining vein.

SPS DAVF can be accessed through extended retrosigmoid approach, but if target vein and DAVF are located in deeper portion as in our cases, presigmoid approach will be safer and better for access without excessive retraction of cerebellum[5]. Even in extended retrosigmoid approach, partial mastoidectomy should be also performed for exposure the sigmoid sinus and transverse-sigmoid junction[8,11] Because only small exposure of presigmoid dura is enough to access and obliterate the leptomeningeal vein without excessive mastoidectomy[5], we believe that presigmoid retrolabyrinthine approach is not an annoying procedure compared with extended retrosigmoid approach.

CONCLUSION

We completely cured patients with SPS DAVFs, in which transvenous embolization was impossible, by simple surgical interruption of the draining vein. Our report demonstrates that direct surgical obliteration is a good treatment option in the DAVF with aggressive behavior, when endovascular embolization therapy is not feasible.

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