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Case Report

Cavernous sinus dural arteriovenous fistula treated with transvenous embolization through facial vein: A case report

Takuto Kuwajima[1,2], Mikiya Beppu[1,2], Kazuhiko Maeda[3], Yoichiro Okada[3], Ryuichi Kohno[3], Shinichi Yoshimura[2]

[1]Department of Neurosurgery, Saiseikai Noe Hospital, Osaka, [2]Department of Neurosurgery, Hyogo Medical University, Nishinomiya, [3]Department of Neurology, Saiseikai Noe Hospital, Osaka, Japan.

E-mail: *Takuto Kuwajima - takutotti@gmail.com; Mikiya Beppu - mikiya.beppu@gmail.com; Kazuhiko Maeda - kazmaeda@kuhp.kyoto-u.ac.jp; Yoichiro Okada - yoaug.1002@gmail.com; Ryuichi Kohno - rkouno@noe.saiseikai.or.jp; Shinichi Yoshimura - hyogoneuro@yahoo.co.jp

***Corresponding author:**
Takuto Kuwajima,
Department of Neurosurgery,
Saiseikai Noe Hospital, Osaka,
Japan.

takutotti@gmail.com

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ABSTRACT

Background: Although the inferior petrosal sinus (IPS) is the most common approach route for transvenous embolization (TVE) of cavernous sinus dural arteriovenous fistulas (CSDAVFs), other routes should be chosen in cases which the IPS is occluded. We report a case in which the superior ophthalmic vein (SOV) approach through the facial vein (FV) was the first choice to achieve radical cure of a hemorrhage-onset CSDAVF.

Case Description: An 81-year-old female presented with a history of transarterial embolization (TAE) and TVE for the left CSDAVF 27 years ago. She was transported to us with a chief complaint of consciousness disturbance, and head computed tomography (CT) showed subcortical hemorrhage in the right frontal lobe. Cerebral angiography revealed CSDAVF with draining into the right SOV and right superficial middle cerebral vein (SMCV). Angiography, computed tomography venography, and contrast-enhanced magnetic resonance imaging did not show IPS, but the outflow pathways to the SOV, FV, and internal jugular vein were confirmed, so an approach through the FV was selected.

Conclusion: The FV was selected through the right femoral vein and thanks to the distal access catheter (DAC) being guided to the SOV, the microcatheter could be easily guided to the SMCV through the cavernous sinus (CS). TVE was performed, complete occlusion was confirmed. When preoperative occlusion of the IPS was confirmed, the FV was useful for the first choice of route, and the use of DAC allowed us to complete the treatment accurately and quickly.

Keywords: Cavernous sinus, Dural arteriovenous fistula, Endovascular treatment, Facial vein, Transvenous embolization

INTRODUCTION

The inferior petrosal sinus (IPS) is the preferred approach route for transvenous embolization (TVE) of cavernous sinus dural arteriovenous fistula (CSDAVF).[2,9] However, there are cases in which the IPS is occluded.[13,15] In such cases, other routes must be chosen. One of such routes is the facial vein (FV). However, the FV is often difficult to guide catheter because of its length and tortuousness at the site where it joins the angular ophthalmic vein and transitions to the superior ophthalmic vein (SOV). We report a case of CSDAVF with occlusion of the IPS, and FV approach was the first choice and a distal access catheter (DAC) was useful to cure the patient.

CASE DESCRIPTION

An 81-year-old female who received had undergone transarterial embolization (TAE) and TVE for the left CSDAVF 27 years ago. Postoperatively, her modified Rankin Scale (mRS) was 0. However, she had been experiencing tinnitus and ocular symptoms on the right side for several months. She was transported with consciousness disturbance (Glasgow Coma Scale: E1V1M4) and seizure, and head computed tomography (CT) [Figure 1] showed a right frontal subcortical hemorrhage. The patient was diagnosed as CSDAVF on cerebral angiography. The feeders were middle meningeal artery (MMA), artery of foramen rotundum, accessory meningeal artery, and ascending pharyngeal artery (APA) [Figure 2a]. The shunt flow was draining to the right SOV and right superficial middle cerebral vein (SMCV) with pseudo phlebitic pattern (PPP), which was considered as the cause of subcortical hemorrhage. There was also a small amount of draining into the basal vein of Rosenthal. On angiography of internal carotid artery, IPS was not visualized [Figure 2b]. CT venography [CTV; Figure 2c] and contrast-enhanced magnetic resonance imaging did not show IPS. The flow to the SOV, FV, and internal jugular vein (IJV) were visualized well, so we decided to perform TVE through the FV. The FV and SOV were very long and strongly tortuous. A tri-coaxial system was used to select this route. First, a 7 Fr long sheath (Terumo, Tokyo, Japan) was inserted into the right femoral vein, and a 7 Fr FUBUKI (Asahi Intecc, Tokyo, Japan) was guiding to the right IJV. A 4 Fr long sheath (Terumo, Tokyo, Japan) was inserted into the right common femoral artery, and a 4 Fr diagnostic catheter was placed in the right external carotid artery for imaging as needed [Figure 3a]. The FV was selected with Synchro SELECT SUPPORT (Stryker, Kalamazoo, Michigan, USA) and SL-10 (Stryker,

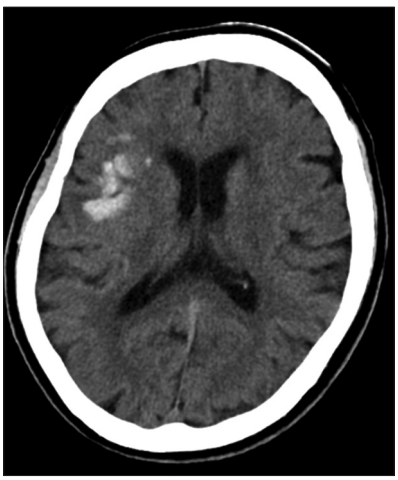

Figure 1: Head CT. Subcortical hemorrhage was confirmed.

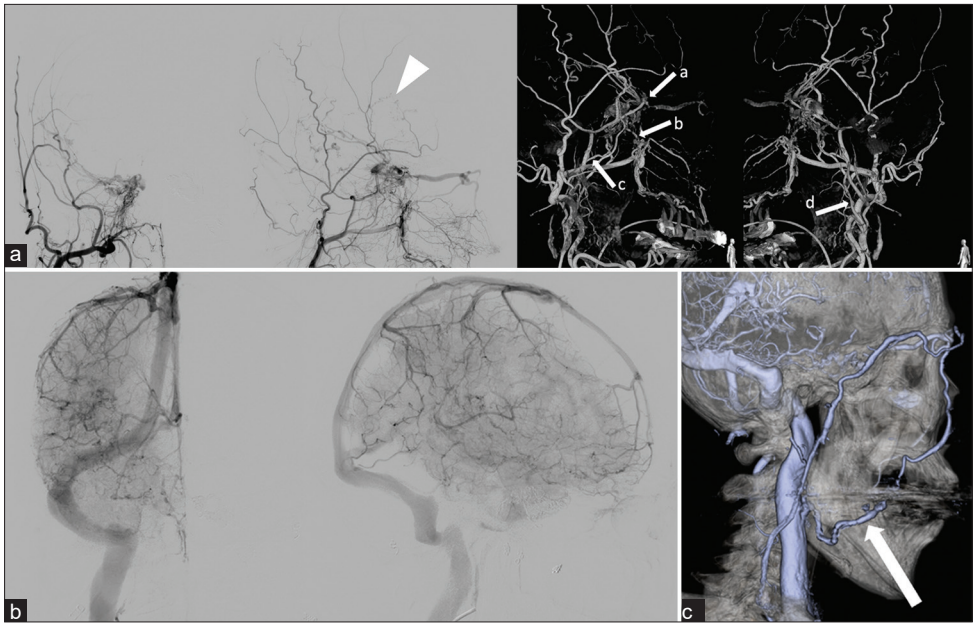

Figure 2: Digital subtraction angiography (DSA) and 3D-DSA (a). On external carotid angiography, the patient was diagnosed as cavernous sinus dural arteriovenous fistula, and the arrow head shows pseudo phlebitic pattern. The arrows show feeders; a: Middle meningeal artery, b: Artery of foramen rotundum, c: Accessory meningeal artery, and d: Ascending pharyngeal artery. DSA (b). On internal carotid angiography, inferior petrosal sinus was not visualized on venous phase. (c) CT venography. Inferior petrosal vein was not detected, and the arrow shows that facial vein was well visualized.

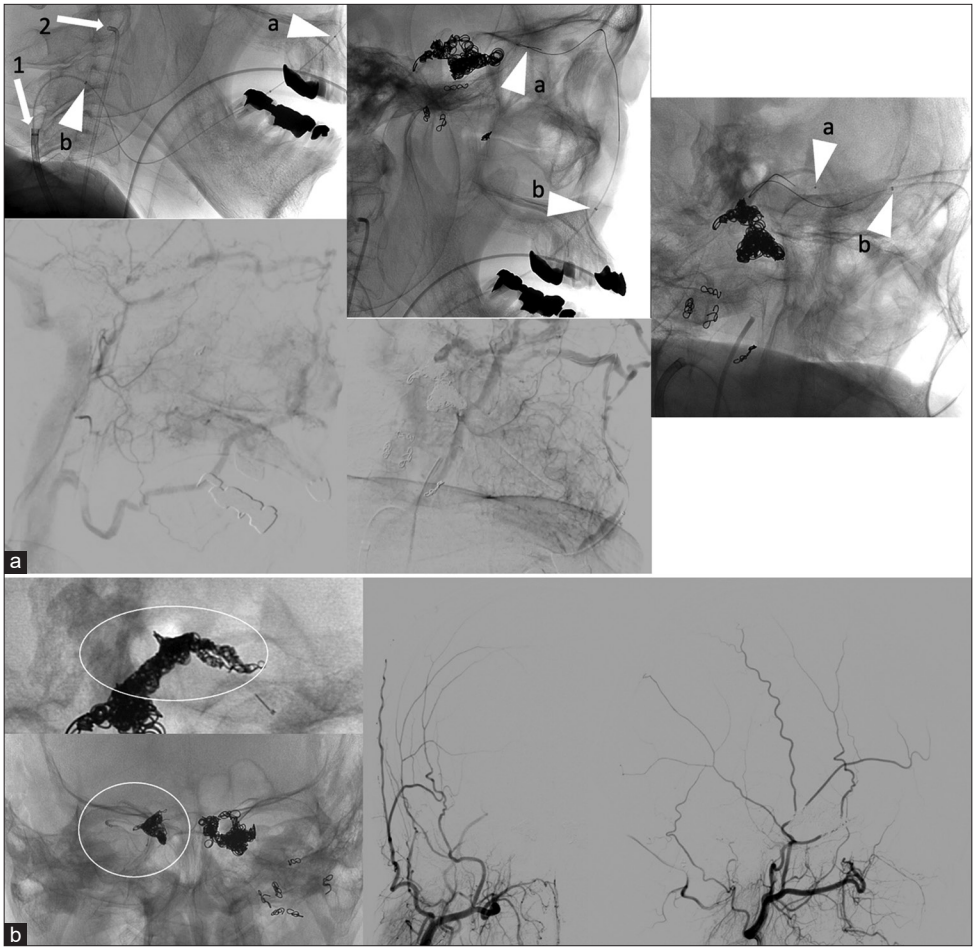

Figure 3: Operative X-ray and digital subtraction angiography (DSA) (a). 7 Fr guiding catheter (arrow 1) was navigated to right internal jugular vein, and 4 Fr diagnostic catheter (arrow 2) was in right external carotid artery. Micro catheter (MC; arrow head a) and distal access catheter (DAC; arrow head b) was navigated to facial vein. MC (arrow head a) was navigated to superior middle cerebral vein superior ophthalmic vein (SOV) through, and DAC (arrow head b) was placed into SOV. DSA shows approach route, facial vein. (b) Coils which were showed in the circle were inserted, and cavernous sinus dural arteriovenous fistula was completely occluded.

Kalamazoo, Michigan, USA) and it was navigated as far as possible. The Guidepost 120 cm (outer diameter: 3.2 Fr, inner diameter: 0.035 inch; Tokai Medical Products, Kasugai, Japan) was used as a DAC, which provided high support even in a strongly bent and tortuous FV. The SL-10 catheter could be navigated to the SMCV by turning back the catheter through the CS [Figure 3a]. A total of 17 coils were then used for embolization. The CS was packed and the regurgitation into the SOV was attenuated. Finally, the shunt point supplied by the APA was also embolized, and the disappearance of the drainer was confirmed. Six vessel studies were performed to confirm complete occlusion of the CSDAVF [Figure 3b]. Postoperatively, ocular symptoms improved promptly. The patient was transferred to a rehabilitation hospital with mRS: 3 due to dysarthria and facial paralysis caused by cerebral hemorrhage.

DISCUSSION

IPS is the preferred approach in TVE for CSDAVF.[2,9] However, there are some cases in which the IPS is occluded.[13,15] There is an alternative approach to reach the CS through the occluded IPS, but the success rate is 54–80%,[4,13] and there have been some cases that are difficult to treat. Various approaches other than IPS have been reported,[2,11] including FV.[1,3,8,10]

One problem with this approach is that the FV is a long vessel with strong tortuosity, so it is necessary to select a catheter and connector appropriately. It has been reported that about 9% of cases drain into the external jugular vein,[5,15] so it is important to evaluate the approach route using preoperative CTV. In addition to CTV, magnetic resonance imaging and 3D-digital subtraction angiography (DSA) are also useful for

preoperative assessment of the approach route. DSA is also useful for preoperative assessment of the approach route.[8,14] In addition to the FV, the route from the CS to the SMCV may also be difficult to reach due to strong tortuosity.

Hirayama *et al*.[8] reported the usefulness of a tri-coaxial system with a 4 Fr guiding catheter inserted into a 6 Fr guiding catheter. In this case, we used a Guidepost 120 cm (outer diameter: 3.2 Fr, inner diameter: 0.035 inch) for the DAC and "T" connectors for the guiding catheter and DAC, respectively, to allow SL-10 to reach the periphery as far as possible. We were able to confirm the FV run and diameter by preoperative DSA and CTA, so we were able to choose the approach through FV from the beginning.[12]

The draining veins of CSDAVF include SOV, SMCV, SPS, IPS, uncal vein (UV), and prepontine bridging vein (PPBV). If the FV is selected as the approach route, there is concern that if the SOV is wedged with a microcatheter during treatment, venous blood that has no outflow pathway will be drained into cortical veins such as SMCV, UV, and PPBV, or into the brainstem. If the SOV is wedged by a microcatheter during treatment, venous blood flow may drain into cortical veins such as the SMCV, UV, or PPBV, or into the brainstem. In this case, the patient had PPP due to regurgitation into the SMCV, which was the source of hemorrhage, and the first step was to embolize this outflow tract. As with all AVFs, it is very important to check for the appearance of new outflow tracts with appropriate contrast. In this case, the patient was aware of tinnitus on the affected side several months before he was sent to the emergency department, so it is possible that the tinnitus originally flowed back into the transverse or sigmoid sinus. As it gradually occluded, the IPS also occluded, and the shunt blood flow probably went to the SMCV.

Hemorrhagic CSDAVF is a very rare condition, with 6 cases (1%) out of 469 cases in JR-NET 2.[6] JR-NET 3[7] reported that CSDAVF has a relatively good prognosis with mortality of 0.5% and morbidity of 3.1%, but in the case of hemorrhagic CSDAVF as in this case, the prognosis is exceptional. However, the case of hemorrhagic CSDAVF, as in the present case, may be an exception to this rule, requiring strict therapeutic strategies and perioperative management.

CONCLUSION

We experienced a case of TVE through FV for CSDAVF with hemorrhage onset. If IPS obstruction is identified preoperatively, it is useful to use the FV as the first choice of route. Furthermore, the use of Guidepost for DAC in this approach is very useful for accurate treatment.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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