CASE REPORT

Embolization of a cavernous carotid fistula through the vein of Labbé: a new alternative transvenous access route

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ABSTRACT

Endovascular treatment of carotid cavernous fistulas (CCFs) via a transvenous approach is standard, but in rare cases this approach is challenging due to absence or thrombosis of the commonly used venous routes. A 61-year-old woman presented with a symptomatic CCF with all but one of the venous access routes to the CCF thrombosed, leaving an engorged superficial middle cerebral vein (SMCV) as the only venous outflow from the cavernous sinus. Access to the CCF was made possible after careful navigation of the sigmoid sinus, the vein of Labbé and the SMCV, bypassing the need for surgical access to the SMCV or for a direct transorbital puncture. The CCF was completely occluded by coiling and Onyx embolization. The patient made an uneventful recovery, with resolution of her symptoms. To the best of our knowledge, this access route has not been previously reported in the treatment of CCFs.

BACKGROUND

The anatomic complexity of the cavernous sinus (CS) makes the endovascular treatment of indirect carotid cavernous fistulas (CCF) the preferred method of treatment. The transvenous approach is favored over the transarterial approach due to the higher rates of occlusion of the CCFs achieved via the transvenous approach.¹ The most common transvenous route is via the inferior petrosal sinus (IPS).¹ If this route is not available, either due to anatomic variation or thrombosis, the CS can usually be accessed via alternative venous routes such as the superior ophthalmic vein (SOV), facial vein, and via direct percutaneous puncture.² Occasionally, even these alternative venous routes may not be available, rendering access to the CS particularly challenging.

We present a case of transvenous embolization of a CCF with a single venous outflow via the superficial middle cerebral vein (SMCV). Access to the CCF was made possible via the vein of Labbé and the SMCV, without the use of microsurgical venotomy.

CASE PRESENTATION

History

A 61-year-old woman developed left orbital proptosis, chemosis, headaches, diplopia and increased intraocular pressure. A catheter angiogram in another institution revealed an indirect, left

CCF with retrograde cortical venous reflux through an engorged SMCV (Barrow type D2). An attempt through the petrosal sinuses and the pterygoid plexus was unsuccessful due to extensive venous thrombosis. The procedure was aborted, and the patient was referred to our institution for a second embolization attempt. At the time of the first angiogram, the left SOV was patent. We prepared for an ultrasound-guided left facial vein stick and access to the CS via the SOV.

After induction of general anesthesia, a complete catheter angiogram was performed with a 5F Terumo glide catheter (Terumo, Somerset, New Jersey, USA). The left CCF had multiple feeders from the left external carotid artery (ECA) branches and the cavernous segment of the left internal carotid artery (ICA), and to a lesser extent from the right ECA and right ICA. The left SOV in the meantime had thrombosed ([figure 1A](#)), and the inferior ophthalmic vein was not visualized, making the engorged left SMCV the only venous outlet from the CCF ([figure 1B](#)). This unexpected change in the venous outflow of the CCF rendered the planned left facial vein stick impractical and necessitated an alternative access route to the fistula. A direct transorbital puncture was not possible since the patient was not consented for this procedure. Similarly, a custom-tailored craniotomy and venotomy of the SMCV would have required for the patient to be consented again and undergo general anesthesia and was deemed to be too invasive. After careful review of the angiograms, we decided to attempt access to the left SMCV and the CS via the vein of Labbé.

Access was gained to the right common femoral vein, and a 6F shuttle sheath (Cook Medical, Bloomington, Indiana, USA) was advanced into the left internal jugular vein. A triaxial system was used, consisting of a DAC 044 catheter (Concentric Medical, Mountain View, California, USA) and an Echelon-10 microcatheter (Medtronic, Minneapolis, Minnesota, USA), with a 90° tip, over a Synchro soft microwire (Stryker Neurovascular, Fremont, California, USA). The intermediate catheter was used to provide support at the origin of the vein of Labbé for the successful navigation of the acute angle formed by the vein of Labbé and the sigmoid sinus ([figure 1C](#)). Once access to the vein of Labbé was gained, the microsystem was retrogradely advanced into the

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Figure 1 (A and B) Left ECA angiogram, lateral views, arterial (A) and venous phase (B). There is an indirect left CCF supplied by multiple ECA branches. The SOV is thrombosed (star). Venous outflow is only via an engorged SMCV (arrow) and subsequently the vein of Labbé (dashed arrow). (C) A triaxial system was used for access. A 6F shuttle sheath is seen at the jugular bulb. The intermediate catheter provided support at the origin of the vein of Labbé for the successful navigation of the acute angle formed by the vein of Labbé and the sigmoid sinus. (D) Once the vein of Labbé was navigated, the microsystem was advanced into the SMCV and eventually the CS. (E) A left CCA angiogram following embolization of the CCF with coils and Onyx demonstrates complete angiographic obliteration of the fistula and absence of retrograde opacification of the left SMCV. (F) Schematic representation of the anatomy of the CCF with the SMCV and the vein of Labbé as the only venous outflow (blue). Other potential venous outflow routes were thrombosed (red). CCF, carotid cavernous fistulas; CS, cavernous sinus; IPS, inferior petrosal sinus; SMCV, superficial middle cerebral vein; SOV, superior ophthalmic vein; SPS, superior petrosal sinus.

SMCV and eventually into the left CS (figure 1D). The CS was sequentially filled with four Axium coils (Medtronic) and occluded completely with 0.8 mL of Onyx 34 and 0.4 mL of Onyx 18 (Medtronic). The final angiographic evaluation showed complete angiographic obliteration of the fistula and absence of retrograde opacification of the left SMCV (figure 1E).

OUTCOME AND FOLLOW-UP

The patient made an uneventful recovery, with resolution of her symptoms and normalization of the left intraocular pressure. A 6-month follow-up angiogram demonstrated the persistent angiographic occlusion of the left CCF.

DISCUSSION

The minimum requirement for the endovascular treatment of a CCF is, of course, the accessibility of the CS by microcatheter. The most common transvenous route is via the IPS. If this route is not available, the CS can usually be accessed via alternative venous routes such as the SOV, facial vein, pterygoid plexus and via direct percutaneous puncture.² Occasionally, even these alternative venous routes may not be available, rendering access to the CS and treatment of the CCF particularly challenging. Hence, there is an interest in having potential alternative access routes available for these challenging cases.

This case report describes a rare situation in which all but one of the venous access routes to the CS had thrombosed, leaving an engorged SMCV as the only venous outflow from the CS (figure 1F). The single, engorged cortical draining vein placed the patient at higher risk of intracranial hemorrhage and necessitated treatment.³ A direct transorbital puncture of the CS⁴ and a custom-tailored craniotomy and venotomy of the SMCV^{5–8} are two approaches that could have resulted in access to the CS. However, both approaches are more invasive than the transfemoral, transvenous access. Careful navigation of the sigmoid sinus, the vein of Labbé and the SMCV enabled full treatment of the CCF, without putting the patient at risk of surgical access to the SMCV or of a direct transorbital puncture. To the best of our knowledge, this access route has not been previously reported in the treatment of CCFs. The SMCV has a variable anatomy, and its relationship with the CS was described in detail by Gailloud *et al.*⁹ The Suzuki classification¹⁰ of the SMCV drainage pathways describes a sphenoparietal type, where the SMCV enters the dura and runs along the lesser wing of the sphenoid sinus to enter the CS, and a cavernous type, where the SMCV enters the anterior end of the CS directly. These two drainage pathways account for up to 60% of the SMCV drainage types encountered. Hence, the SMCV and, by extension, the vein of Labbé, are potential access routes during the transvenous embolization of CCFs in a significant proportion of the cases.

Learning points

- ▶ The commonly used transvenous access routes to the cavernous sinus can be inaccessible due to thrombosis or anatomic variation, making the endovascular treatment of carotid cavernous fistula (CCFs) particularly challenging.
- ▶ A custom-tailored craniotomy and venotomy of the superficial middle cerebral vein (SMCV) has been advocated as a combined neurosurgical and endovascular approach in CCFs where the SMCV is the main venous outflow.
- ▶ This report describes a previously unreported transvenous access route to the CCF through the vein of Labbé and the SMCV.
- ▶ This new transvenous access can be used in CCFs draining to an engorged SMCV, obliterating the need for more invasive approaches, such as craniotomy and venotomy.

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