Traumatic carotid–cavernous fistula treated by combined transarterial and transvenous coil embolization and associated cavernous internal carotid artery dissection treated with stent placement

Case report

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The authors report on a case in which a carotid–cavernous fistula and an associated cavernous–carotid dissection developed in a 48-year-old man following a motor vehicle accident. The fistula was treated with coil embolization via a combined transarterial–transvenous approach. The dissected carotid artery segment was treated with a balloon-expandable stent, which restored normal caliber and hemispheric flow. There was no recurrence of the fistula and the postoperative wide patency of the carotid artery indicates that stent placement is an effective method of treating traumatic intracranial artery dissections.

KEY WORDS • internal carotid artery • dissection • carotid–cavernous fistula • embolization • stent • Guglielmi Detachable Coil

We report on a case in which a CCF with a cavernous pouch was treated using combined transarterial and transvenous coil embolization and an associated cavernous ICA dissection was treated with stent placement.

Case Report

History and Examination. This 48-year-old man developed a left-sided CCF a few weeks after he was involved in a motor vehicle accident. The left ICA angiogram revealed severe and smooth narrowing of the vertical portion of the cavernous ICA and a fistula distal to this segment (Fig. 1 upper left and center). The contrast medium passing through the fistula filled a large cavernous pouch and then the superior ophthalmic vein, which drained to the facial veins via the left angular vein. Some of the fistulous flow drained through the pterygoid veins, but not through the inferior petrosal vein. The ICA distal to the fistula was patent but most likely insufficient to maintain perfusion pressure, because there was evidence of collateral flow to the left hemisphere via the ACoA (Fig. 1 upper center). After the initial angiographic assessment, the patient was scheduled for endovascular treatment.

Operation. Detachable balloon embolization of the fistula was avoided because of the risk of getting stuck in the narrow artery segment proximal to the fistula. Furthermore, we thought that the narrowing was likely caused by traumatic dissection of this segment and that manipulations with detachable balloons and their introduction systems in this region might worsen the dissection. We decided to use detachable coils to embolize both the fistula and the large cavernous pouch, the latter seeming to be a pseudoaneurysm that had developed a small hole into the cavernous sinus. The procedure was conducted while the patient received intravenous heparinization. The cavernous pouch was embolized with Guglielmi Detachable Coils (Target Therapeutics, Fremont, CA) through a microcatheter placed via a transarterial route. Although the cavernous pouch was angiographically demonstrated to be filled with coils, the fistula was still patent (Fig. 1 upper right) and the last coil tended to migrate into the ICA. The procedure was halted at this point and the stent placement was performed immediately (Fig. 1 lower left). Thereafter, the cavernous pouch was catheterized again and five more coils were packed, after which the fistula was still patent.

When our attempts to reposition the catheter tip toward the superior ophthalmic vein failed, we established venous access at the jugular bulb and attempted direct venous access to the cavernous sinus. Despite mild resistance, a direct access was achieved through the right jugular bulb with a 6 French catheter and a microcatheter was advanced to the cavernous sinus. An angiographic

Abbreviations used in this paper: ACoA = anterior communicating artery; CCF = carotid–cavernous fistula; ICA = internal carotid artery.
access through the left femoral vein and placed a guiding catheter into the left internal jugular vein. We attempted to place a microcatheter in the left inferior petrosal vein but this failed. Then we placed the guiding catheter in the left facial vein and navigated a microcatheter through this vein into the left superior ophthalmic vein via the angular vein. The microcatheter was advanced as far as the connection between the cavernous pouch and the ophthalmic vein, and the connection site was occluded with additional Gugliemi Detachable Coils.

Postoperative Course. The postprocedure ICA angiogram revealed complete closure of the fistula and cessation of collateral flow to the left hemisphere (Fig. 1 lower left). Heparinization was continued for 24 hours after surgery; ticlopidine (250 mg/day) was scheduled to be taken for 1 month postsurgery, and aspirin (100 mg/day) was prescribed for the remainder of the patient’s lifetime.

Complete relief of preoperative exophthalmos was observed after the procedure. The follow-up angiogram obtained at 4 months revealed wide patency of the cavernous ICA with no fistula (Fig. 1 lower right). It was noted that the slightly oversized lumen containing the stent had equalized to the size of the adjacent normal lumen. Further follow up was planned as clinical assessments at annual intervals.

Discussion

Coil embolization by transarterial, transvenous, or a combination of both routes in the treatment of CCFs is well known and proved to be effective in our case too. A distinctive feature in our patient was an associated cavernous ICA dissection. Although both CCFs and ICA dissections are known complications of trauma, the true incidence of their coexistence is not known. An associated ICA dissection definitely has a major impact on endovascular treatment, because it narrows and even occludes the arterial lumen. Therefore, in most previous cases surgeons have either treated the fistula via a transvenous approach and left the dissection as it was or they have occluded the ICA together with the fistula. Although the cavernous ICA dissection in our case did not preclude access to the CCF orifice with a microcatheter, we inserted a stent into the dissected segment for the following purposes. The first goal was to treat the dissection. The conventional method of treating traumatic dissection is long-term anticoagulation. In an experimental study in which the natural history of unrepaired intimal flaps was characterized, however, the authors concluded that arteries with hemodynamically significant stenosis from intimal flaps warranted repair because of the tendency for thrombus formation with subsequent distal
emboli and arterial occlusion. Arterial stent placement is an attractive therapeutic option in an arterial dissection with high-grade stenosis because it seals the intimal flap against the arterial wall and preserves luminal patency. Nevertheless, keeping in mind that intravascular navigation of a stent introduction system may itself be a potential source of dissection, stent placement in a dissected arterial segment should be performed with extreme caution by experienced teams.

Second, we endeavored to restore the cavernous ICA caliber and normalize hemispheric ICA flow. Indeed, there was no more collateral flow to the left hemisphere after the stent placement and fistula closure. The evidence for collateral flow did not necessarily show ischemia and thus it was not an absolute indication for stent insertion; however, we took advantage of a novel means of treating a dissected artery while considering possible future damage to collateral pathways.

Third, the coils tended to migrate into the ICA lumen during the procedure. Stents helped to keep the coils within the cavernous pouch.

References


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