Recurrent Carotico-Cavernous Fistula after Internal Carotid Artery Ligation: a Case with Embolization of the Fistula Via Contralateral Internal Carotid Artery Approach

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Summary

We are reporting a 51-year-old female patient having a history of direct carotid cavernous fistula (CCF) which was treated by internal carotid artery (ICA) ligation 17 year ago. She presented to Ho Chi Minh City University Medical Center with symptoms of recurrent CCF. The recurred CCF was supplied by multiple feeders coming from anterior, posterior communicating artery and the recanalized left ICA. Her CCF was not plausible for another surgical ligation and was referred for endovascular treatment. The fistula was eventually occluded by percutaneous embolization via the right ICA approach. Through this case, we would like to discuss about the treatment strategies of those having recurrent CCF with preexisted ICA ligation.

In Vietnam, previously carotico-cavernous fistula was mainly treated with muscle occlusion, carotid artery ligation or combinations of these methods. There were reported good outcomes for treatment of CCF surgically. However, surgical repairs had carried, not only complication, but a risk of recurrence due to recanalization of the previously ligated ICA.

Since the emergence of endovascular intervention, the treatment of direct CCF has evolved from surgical ligation to angiographic embolization using balloon or coils via artery route or

venous access. This endovascular method currently is the treatment of choice for traumatic CCF due to its ability to preserve the carotid artery and flexibility in treatment strategy with various approaches to the fistula.

Introduction

Carotid cavernous fistula is a shunt between carotid artery and the cavernous sinus which is a subtype of dural arterio-venous fistula. The common cause of CCF is head trauma or rupture of the cavernous ICA aneurysm, in that case, the fistula is called direct CCF or traumatic carotid cavernous fistula. The incidence of direct CCF is not well documented in Vietnam but this issue would probably be of high incidence because of the high rate of motor vehicle accident and injury¹.

Case Report

Ms H was a 51-year-old woman who had a history of motor vehicle accident 17 years ago causing her a head injury and fractures at her left leg. After being recovered from the injury in several months, she subsequently developed left direct CCF and was treated by left ICA ligation.

Figure 1 A,B): Images from left CCA run showed a long-segment irregular stenosis of the recanalized left ICA (1). The CCF was still present (2). Left ophthalmic vein (3). Cortical vein refluxes (4) with aneurysmal dilatation of the left vein of Labbe (5). Dilated left vein of Labbe (6). Dilated vein of Trolard (7). Superior sagittal sinus (8).

Figure 2 Cerebral angiogram showing high flow CCF on the left ICA. (A,B) AP and lateral views from the left CCA run. (C,D) AP and lateral views from the right ICA run.

She was then doing well except until recently that she presented to our center with headache and left eye redness in four months backward. She also complained of hearing a pulsatile noise in the left ear. Her headache can be reduced with analgesics but her life was severely affected with the left ear noise that caused her insomnia. On arrival examination, she had a full Glasgow comma scale (GCS) and had no neurological deficit. Her left eye was congested with mild exophthalmos but her vision was not reduced. There was systolic bruit by auscultation on her left eyelid extending to the temporal region. In

the overall picture, her symptoms were suggestive of a recurrent left CCF.

The diagnostic angiogram was performed which showed a long segment of irregular thread-like residual flow at the proximal part of the left ICA which were in keeping with recanalization of this artery post ligation (Figure 1). The left hemisphere was well supplied by the right ICA via the anterior communicating arteries (Acom). The direct CCF were still present which was partially supplied by the residual left ICA, the right ICA via Acom (Figure 2) and basilar artery via left posterior communi-

cating artery (Pcom) which was demonstrated in the left vertebral artery run. The left external carotid artery also contributed flow to the CCF through the anastomoses of branches of right maxillary artery with the left ophthalmic artery. The fistula was drained by dilated and tortuous venous networks including left ophthalmic vein, left inferior and superior petrosal sinuses, cortical venous system including vein of Trolard, superior cerebral veins and vein of Labbe. There was ectasia of subarachnoid and cortical veins of the left hemisphere with aneurysmal dilatation of the left vein of Labbe. The right cavernous sinus was intact.

Because the fistula was fed by multiple sources of blood flow which were from posterior circulation and from the right ICA, another repeated surgical repair was found impossible, and the patient was referred for endovascular intervention. Under assessment angiographically, the balloon embolization was not the treatment option for this case because there was no route for the balloon approach. We decided to proceed with occlusion of the fistulous portion of the left carotid artery through the right ICA via anterior communicating artery.

The 6F soft tip guiding catheter was introduced into the distal part of the cervical portion of the right ICA. A micro catheter Echelon 1.7 with hybrid 0.007" micro-guidewire were used for selective cannulation of the right anterior cerebral artery to the anterior communicating artery, the left anterior cerebral artery and going to the left distal ICA (Figure 3). A total of 7 coils (8 mm×30 cm and 6 mm×30 cm) were packed into the residual portion of the left ICA and the cavernous sinus. Post embolization runs showed total occlusion of the rest of the left ICA with no more supplied from the right ICA to the fistula (Figure 4). There is minimal residual flow supplied from the left Pcom into the cavernous sinus which was then occluded in a while afterward due to cavernous sinus thrombosis. Symptom assessment a few hours after the procedure revealed that her eye has got immediate reduction of redness with total disappearance of her left ear noise. She was alert and showed no immediate complication.

Discussion

Before the emergence of endovascular intervention, CCF was treated with muscle embolization, ICA ligation or combination. In the lit-

eratures, the cured rate of open surgery for treatment of CCF is about 78.8% with both intracranial ICA occlusion and cervical ICA ligation². In Vietnam, the report of successful rates of muscle occlusion for the treatment of the CCF was about 86.2%. The complication rate of surgical muscle occlusion was about 4%. The incidence of CCF recurrence after muscle occlusion was about 7%³. The incidence of recurrent CCF after a CCA ligation was not well documented but was considered very uncommon. It can occur after a very long period of time which can be up to 47 year⁴.

Since the development of endovascular intervention, this method become expanded and remains the modality of choice as the treatment for CCF. For direct carotid cavernous fistula (type A), the detachable balloon has been the best available method of treatment^{2,5}. Successful cured rate of endovascular intervention for CCF was about 98.3% with reservation of the carotid artery in 70.9%. The complication rate was 1.1% and the death rate was 0.6%⁵.

The complication rate of endovascular embolization for CCF was different on various centers. Other authors showed that permanent complication of cerebral infarction was less than 2%. Permanent cranial nerve after the procedure occurs in 0-5%. Death also was reported at 1.8 (Kendall et al, 1983) to 3% (Scialfa et al, 1983)². Other rare complications include premature balloon detachment, balloon dislodgement and migration. The advantage of endovascular intervention is the possible preservation of the internal carotid artery which was approximately 70% of cases^{2,5}.

In recurrence CCF, though the possible treatment could be a repeat of another ligation⁴ but mechanically, the treatment with endovascular intervention appears to be more flexible with more options for fistulous accesses. The endovascular embolization can be via venous approach to the cavernous sinus and pack the cavernous sinus with coils⁵ or via the ipsilateral ICA into the fistula if the recanalized lumen of the previously ligated ICA which is still spacious enough. If the common carotid artery is ligated, direct ICA puncture can be an alternative^{5,6}. Other approach can be from the posterior circulation via the posterior communicating artery⁷.

In our case, the fistula showed inaccessible through draining venous systems because the inferior petrosal sinus was not dilated and the other venous drainage were too tortuous. On

Figure 3 Fistula access with microcatheter. (A) First few coils were put into the left ICA and the cavernous sinus (B).

Figure 4 A,B) Post-embolization image showed total occlusion of the left cavernous sinus (1). The left MCA (2) was supplied from the right ICA.

the other hand, the left ICA was recanalized but the lumen was so tiny for cannulation. Because the stenosed part of the left ICA was too long, direct ICA puncture was not applicable. The

other consideration was the approach from the posterior communicating artery, however, this route appeared not appropriate for cannulation to the proximal ICA due to acute angle with the

ICA. The only final option is to approach and embolize the fistula via the contralateral ICA through anterior communicating artery.

Conclusion

Endovascular Intervention is currently a treatment of choice for treatment of CCF because its high cure rate, less complication, abil-

ity to preserve the carotid artery and flexibility to gain various accesses to the fistulous sites. In cases of CCF recurrence after preexisting carotid artery ligation, the fistula approaches can be through ipsilateral Pcom, direct puncture of the cervical ICA, through superior ophthalmic vein or within the petrosal sinus. Alternatively, the treatment can be achievable via the contralateral internal carotid artery through the anterior communicating artery.

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