Case Report

Endovascular treatment with transvenous approach for embolization of carotid cavernous fistula

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Abstrak

Tata laksana endovaskular terhadap fistula kavernosa karotid bertujuan menutup robekan pada bagian sinus kavernosa. Hal ini dapat dilakukan baik dengan pendekatan trans-venosa atau pendekatan trans-arteri. Pilihan ini tergantung pada jenis fistula dan arsitektur pembuluh darah. Kami mendeksripsikan dua pendekatan trans-venosa yang berbeda difokuskan pada pertimbangan anatomi dan aspek teknis.

Abstract

The aim of endovascular treatment in carotid cavernous fistula is to close the tear side at cavernous sinus part. It can be dealt either by transvenous or transarterial approach. The option is influenced by type of fistula and angioarchitectural findings. We described two different transvenous routes emphasizing on anatomical consideration and its technical aspect.

Keywords: carotid-cavernous fistula, coiling embolization, transvenous

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Generally, there are two types of carotid cavernous fistula (CCF), namely direct and indirect type. Direct type is inherently resulted from trauma. Indirect fistula occurs spontaneously is adural communication at cavernous sinus with meningeal branches either from internal or external carotid arteries, or both. When CCF harbored for treatment, endovascular is the mainstay option for its high efficacy and low complication risk as compared to surgery.[1]

The aim of endovascular technique is to seal the tear site at cavernous part. It can be achieved by catheterization into cavernous sinus (CS) to allow placement of various embolization materials. CS cannulation through transvenous route has benefit of much safer than transarterial approach. It is the preferred method in indirect type CCF.[2] In the direct type, transvenous can serve a complementary breakthrough if trial balloon occlusion into the CS via transarterial route fail to completely obliterate the fistula.[1,3]

We would like to describe our experience in this noble transvenous method weighting in CCF angioarchitectural background and technical hindrance that prompt us to perform transvenous technique.

CASE REPORT

Direct CCF case

A 26 year-old lady presented with right eye's conjunctiva chemosis, proptosis and visual disturbance following motor-vehicle head trauma two weeks prior. Due to the nature of her eye's problems associated with trauma, a direct type CCF was suspected. A diagnostic cerebral angiogram was immediately done which confirmed a direct type of right CCF with fast flow shunt (Figure 1). A decision of endovascular treatment was taken after a board of multidisciplinary discussion from neurosurgical, eye and radiology teams. The first

attempt was catheterization of the affected CS from right internal carotid artery (ICA) route. Balloon-microcatheter assembly managed to reach the CS by the rent site. Trial of balloon inflation showed incomplete closing of the fistula due to suboptimal conform of balloon over the tear area. We decided to abandon this transarterial way and proceeded with transvenous catheterization via inferior petrosal sinus (IPS) which clearly demonstrated angiographically. The right internal jugular vein (IJV) was approached using a 6 F guiding catheter (Figure 2). Coaxial inserted microcatheter success to catheterize the targeted CS via IPS. At this point, we were certain to pack the cavernous area with microcoils to promote complete closure of CCF. Following coils embolization, a right internal carotid artery (ICA) arteriogram showed disappearance of the CCF (Figure 3).

Indirect CCF case

A 28-year old female presented to eye clinic with spontaneous proptosis and chemosis of the right eye for the past 3 months. There was no associated visual impairment of note. Eye tonometry revealed significant increased right eye's pressure. Diagnostic angiography showed indirect right CCF, supplied by meningeal branches of both right ICA and external carotid arteries (ECA) (Figure 4a and 4b). A decision to undertake endovascular treatment was done to prevent vision loss. After evaluating the angiographic findings, we decided to reach the affected CS from superior ophthalmic vein (SOV) via transfacial venous catheterization as the shorter route via IPS was not opacified. A 4 F vertebral diagnostic catheter was placed at the right IJV. Microcatheter with 0.016" microwirecoaxially inside the vertebral

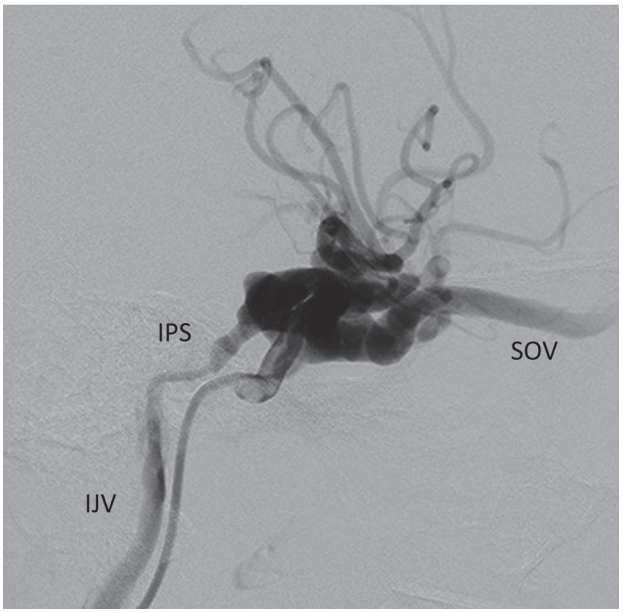

Figure 1. Direct type of right carotid cavernous fistula demonstrated with retrograde flow into superior ophthalmic vein (SOV) and inferior petrosal sinus (IPS) that eventually drain into internal jugular vein (IJV)

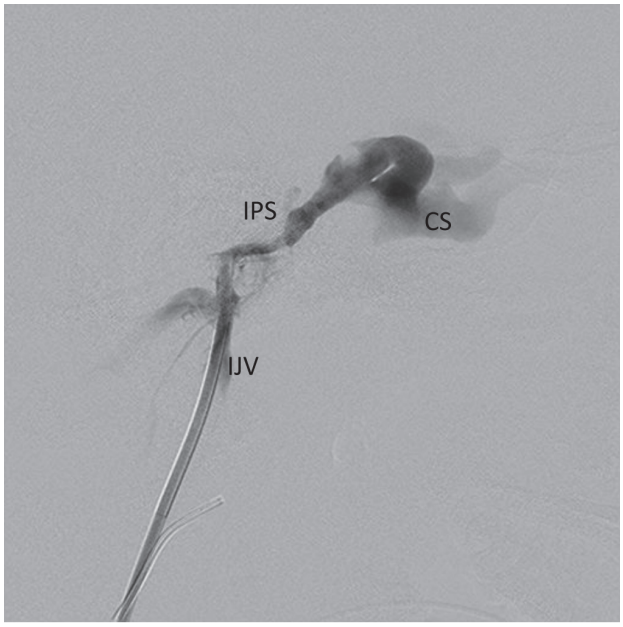

Figure 2. The posterior venous tributary of cavernous sinus (CS) was approached from internal jugular vein (IJV) using guiding catheter. Later, coaxial inserted microcatheter navigated into CS through inferior petrosal sinus (IPS)

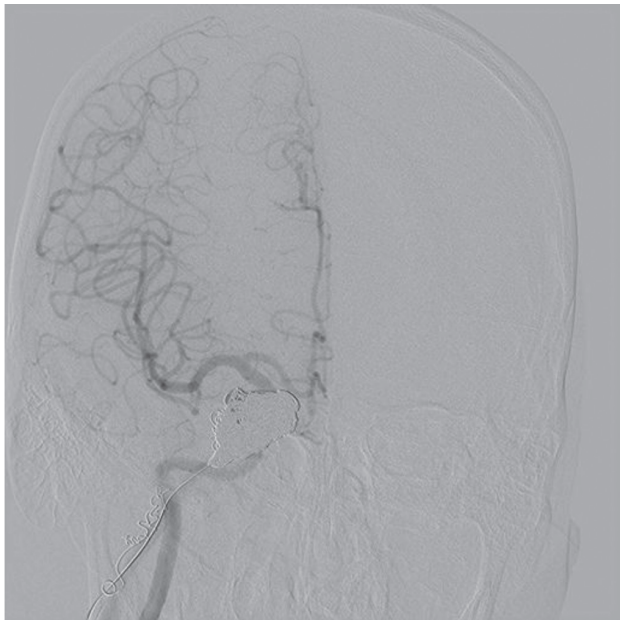

Figure 3. Complete closing of the fistula after coil packing seen from check right ICA arteriogram

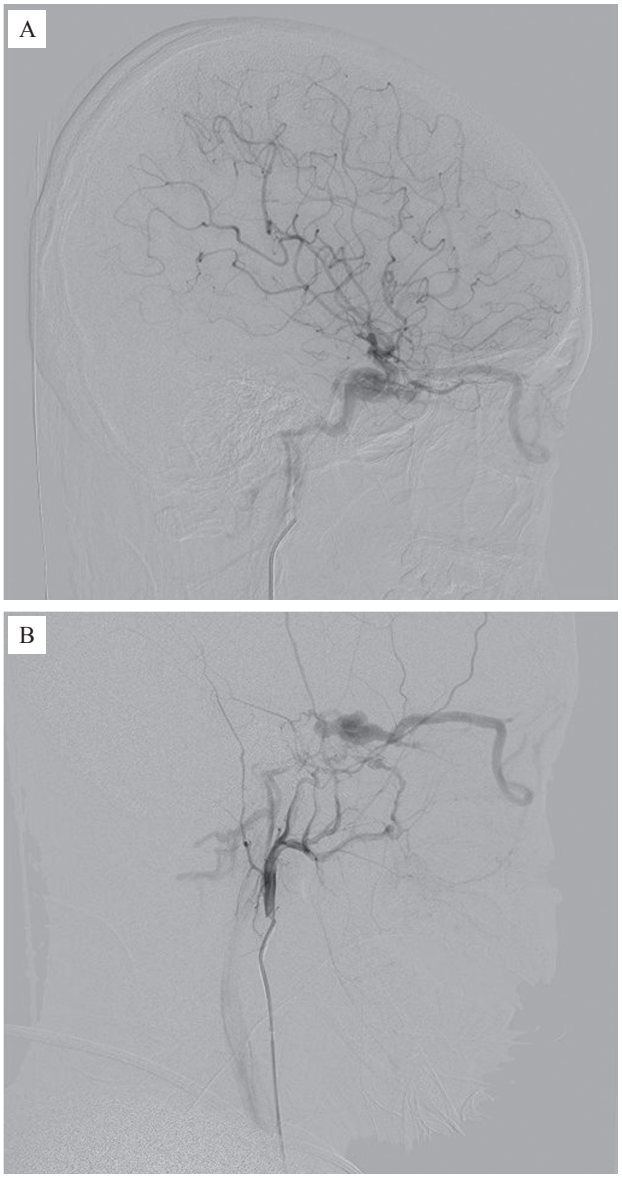

Figure 4. A) Arteriogram of right internal carotid artery showed a low flow of indirect carotid cavernous fistula; B) The CCF received supplies from dural branches of internal maxillary artery displayed from right external carotid arteriogram

catheter (Figure 5) used to navigate the facial vein drained into IJV. Laborious catheterization was required due to intermittent venous spasm, angulation and narrowing of this pertinent vein particularly on the turningpart at the orbital rim where it continued into SOV. After successfully advancing the microcatheter into CS via the SOV, contrast injection done for confirmation (Figure 5). Subsequently, this right CS was packed with electrically detachable coils to cease the fistula's shunt. Final check angiogram of right internal (Figure 6a) and external arteries (Figure 6b) showed complete obliteration of the indirect right CCF after coiling embolization.

Figure 5. Long route of transvenous catheterization into cavernous sinus (CS) starting from facial vein (FV) with an acute turning point before reaching superior ophthalmic vein (SOV)

DISCUSSION

Clinical presentation of CCF primarily involves eye symptoms, ranging from proptosis, chemosis, diplopia to reduced eye vision. Spontaneous obliteration of CCF is hardly occurred for that most of CCF requires endovascular treatment. Rapid deterioration of vision acuity is the main indication for treatment in most of clinical ground practices. Other indication for immediate treatment includes cortical venous reflux due to its high risk for cerebral venous hypertension and intra cranial bleed.[1-3]

In direct CCF, our treatment approach is a stepwise procedure, with transarterial route as the first attempt. Technically, navigation of microcatheter into cavernous sinus' fistula area through internal carotid artery is always feasible.[1] The hindrance is to achieve accurate placement of occlusion balloon over the tear's site for complete fistula's obliteration. If this trial is not successful, then we proceed with transvenous catheterization into CS for coils embolization. Our aim is to coil the affected compartment of CS that ultimately seal the tear site.

In indirect type, transvenous technique is our preferential technique especially in fistula that fed by internal carotid meningeal branches. It is

Figure 6. Post coiling embolization, angiography of right ICA (A) and ECA (B) showed a complete obliteration of fistula and its retrograde venous flow.

because embolization of meningeal branch ICA carries a risk of stroke. Compounding into it is the small size, tortuosity and distal site of meningeal branches that preclude a safe and close distance catheterization into the fistula site.[3,4]

The en-route option for transvenous is based on the angiographic presence of the venous drainage. Our experience is limited on SOV via transfacial vein and IPS via IJV. The option of either of these two venous route depends on the angioarchictectural of them which we analyze before interventional procedure. A non-opacified inferior petrosal sinus circumvents us for taking it as venous access although IPS is the shortest and straightest route in reaching CS area.

In contrary, catheterization of SOV via facial vein requires tedious effort due to its long route with narrowing and tortuous course as it enters the orbital rim. The other potential technical difficulty is the numerous side branches of facial vein, small caliber and its intermittent vasospasm. Direct SOV catheterization can be done after surgical exposure of the superior eye lid. However, direct SOV approach requires vast experience with fine and flexible endovascular platform to ensure low risk of ophthalmic vein injury. Worsening proptosis due to retroorbital hematoma could be occurred in the event of ophthalmic vein injury.[4,5]

Success rate of transvenous approach was reported to be significant high, ranging from 76% to 86.5%. Yu, et al[6,7] suggested a stratification of venous routes based on angioarchitectural of the venous pathway from the shunt's flow. This venogram stratification useful for pre-embolization planning and reported to increase the success rate of endovascular treatment as well as reducing procedure times and radiation dose to operators and patients.

In conclusion, transvenous approach is useful and safe for both type, direct and indirect CCF. Assessing venous pathway of the fistula prior to embolization has benefits of increasing the success of embolization. Facial vein catheterization serves an effective alternative route over IPS if the latter vein is not completely seen.

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