

## Case Report

# Intra-Arterial Onyx-18 Embolization of a Dural Arteriovenous Fistula of the Sphenoparietal Sinus Using Scepter C Balloon Microcatheter: Case Report

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### ABSTRACT

Dural arteriovenous fistulas (DAVFs) of the sphenoparietal sinus are extremely rare. In the present report, we describe a 46-year-old male patient who presented with headache, pulsatile tinnitus on the right side, and a single course of focal seizure starting 2 months after a closed head injury causing right temporal and occipital bone fractures. Cranial magnetic resonance imaging which was obtained 11 months after the injury showed white matter necrosis in the right frontal lobe while digital subtraction angiography (DSA) revealed a right-sided DAVF in the region of sphenoparietal sinus. The patient underwent successful intra-arterial Onyx-18 embolization using Scepter C balloon microcatheter. Complete occlusion of the fistula was confirmed by control cerebral DSA at 6-month follow-up. Thus, we conclude that double lumen Scepter C balloon microcatheter is a feasible, safe and effective treatment for intra-arterial Onyx-18 embolization of the DAVFs of the sphenoparietal sinus, particularly in cases with high tortuosity.

**KEYWORDS:** Balloon catheter, dural arteriovenous fistula, embolization, Onyx-18, sphenoparietal sinus

## INTRODUCTION

Dural arteriovenous fistulas (DAVFs) are defined as abnormal vascular shunts between the arterial feeders and veins or sinuses within the leaflets of the dura, representing 10–15% of overall intracranial arteriovenous malformations.<sup>[1]</sup> Junction of transverse and sigmoid sinuses as well as cavernous sinus region are the most common locations for DAVFs followed by superior sagittal sinus (SSS), torcula, and tentorium.<sup>[2]</sup> Clinical manifestations vary from headache, pulsatile tinnitus and/or orbital symptoms (chemosis, proptosis, ophthalmoplegia, etc.) to more aggressive presentations including increased intracranial pressure, seizures, and focal neurologic deficits, depending on the venous drainage pattern and localization of the fistula. However, in cases lacking cortical venous drainage, clinical course may be silent.<sup>[2]</sup>

DAVFs of the sphenoparietal sinus (SS) are extremely rare; thus, relevant literature is limited. Generally, DAVFs draining into the SS are of traumatic origin and are supplied by the anterior branch of the middle meningeal artery (MMA), recurrent meningeal branch of the ophthalmic artery (RMOA) or posterior ethmoidal artery (PEA).<sup>[3,4]</sup> Endovascular embolization is the treatment of choice in majority of the cases.<sup>[5]</sup>

Here, we describe our experience with transarterial balloon-assisted Onyx-18 embolization via double-lumen

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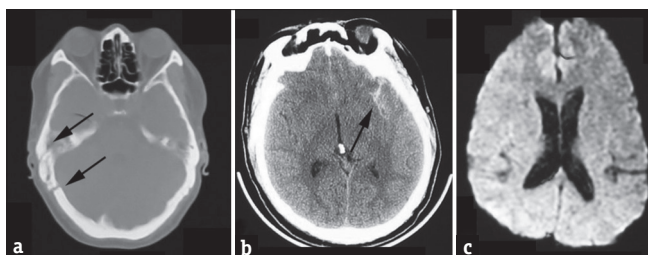
balloon microcatheter, Scepter-C, in a patient who presented with post-traumatic DAVF of the SS.

## CASE REPORTS

A previously healthy, 46-year-old man presented to our out-patient neurosurgery clinic with a 9-month history of gradually worsening right-sided pulse-synchronous tinnitus, headache and a single course of focal seizure on the left side. Physical examination revealed right temporal bruit while neurological examination was unremarkable. Indeed, the patient had a history of motor vehicle accident 11-months ago. Immediately after the accident, he was admitted to his local emergency department where the initial non-contrast computerized tomography (CT) scan of the head was obtained. The CT scan revealed a longitudinal right temporal and a linear, non-displaced occipital bone fractures with traumatic subarachnoid hemorrhage in the left Sylvian fissure [Figure 1a, b]. Cranial magnetic resonance (MR) imaging was within normal limits [Figure 1c]. Nonetheless, after the surveillance period he was discharged home safely.

Cranial non-contrast MR imaging which was obtained after his admission to our clinic, demonstrated areas of necrosis and flow-voids in the right frontal white matter [Figure 2a] while time of flight (TOF) MR angiogram showed dilated right sphenoparietal and Sylvian veins [Figure 2b]. As a vascular pathology was highly suspected, the patient proceeded to cerebral digital subtraction angiography (DSA). It demonstrated a DAVF in the region of SS which supplied by the right MMA and draining into the SSS through dilated and tortuous Sylvian veins [Figure 2c, d].

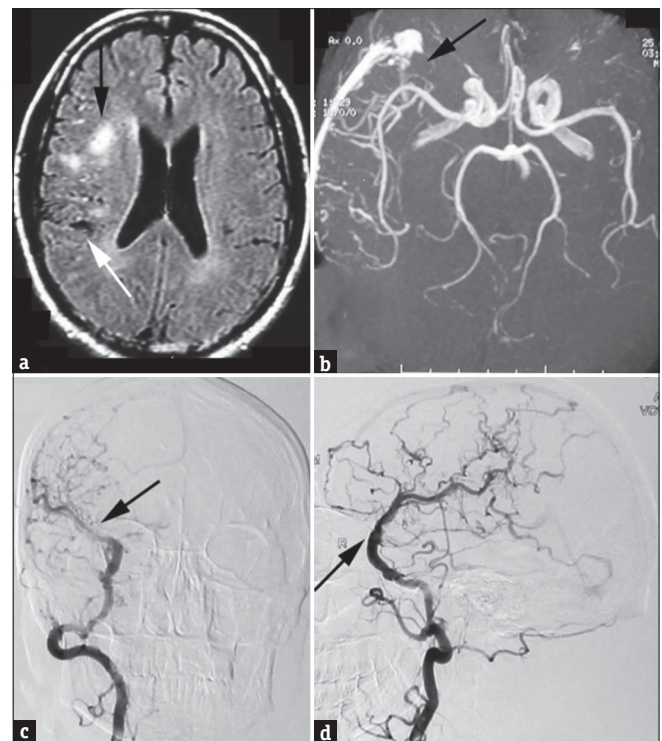
Transarterial embolization of the fistula by Onyx-18 (EV3, Irvine, California, USA) injection was performed with the patient under general anesthesia. Heparin was administered intravenously with bolus dose of 0.5 mg/kg. The activated clotting time was not measured during the embolization. First, A 6-French



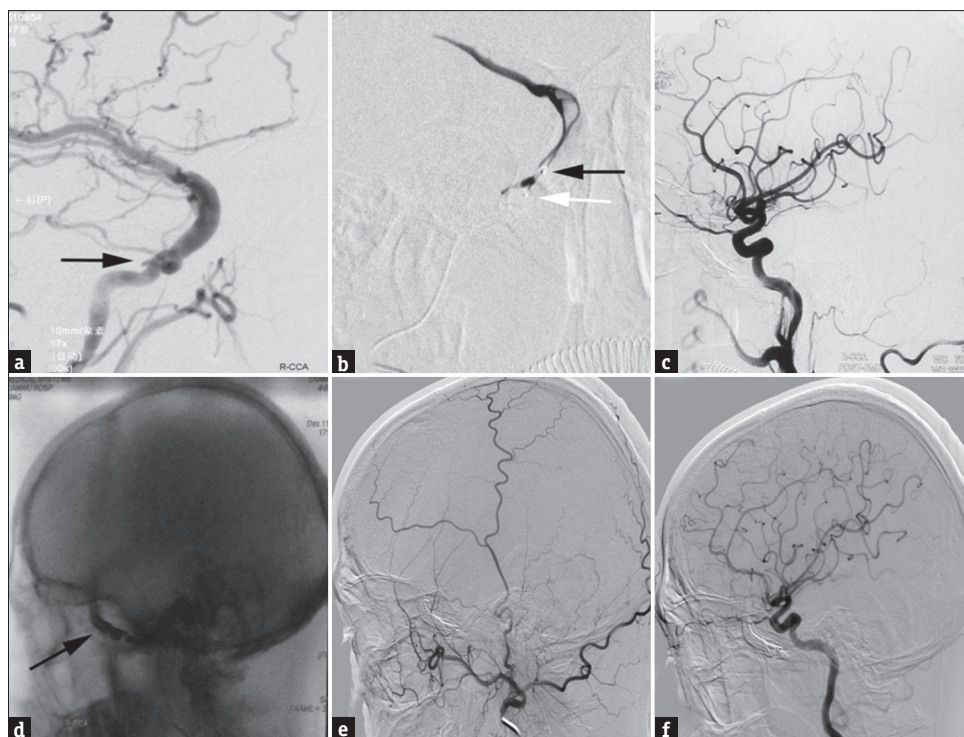
**Figure 1:** Axial non-contrast head CT images obtained immediately after the trauma revealing right temporal and occipital linear fractures (a), and traumatic subarachnoid hemorrhage in the left Sylvian fissure (b) in bone and parenchyma windows, respectively (black arrows). Axial images of diffusion-weighted MR imaging (c) demonstrating lack of additional pathology after the trauma

guiding catheter (Envoy 6 Fr, Coddman Neurovascular) was introduced transfemorally into the main trunk of the right external carotid artery. The angiographic architecture and exact location of the fistula were further analyzed by 3-dimensional reconstruction of conventional DSA. Then, a coaxial dual lumen Scepter-C (MicroVention, Tustin, California, USA) balloon microcatheter was advanced to the location of the fistula through the anterior branch of the MMA over a 0.014-inch micro-guidewire (Traxus-14, MicroVention, Tustin, California, USA) under digital roadmap guidance. With the balloon inflated, a total of 2.2 cc Onyx-18 was delivered through the balloon-catheter under sustained fluoroscopic monitoring. Once the Onyx-18 adequately penetrated into the fistula and proximal parts of the dural veins, complete occlusion was confirmed by DSA, thus, the infusion was ceased immediately [Figure 3a-c].

The procedure was uneventful, and the patient did not suffer any procedure-related complications. After 1 day of hospitalization for surveillance, he was discharged home with immediate relief of tinnitus and headache. Complete occlusion of the DAVF was confirmed by DSA at 6-month follow-up [Figure 3d-f].



**Figure 2:** Axial FLAIR MR images demonstrating hyperintensity (black arrow) and flow-void areas (white arrow) in the right frontal white matter 11 months after the trauma (a). TOF MR angiogram revealing dilation of the right sphenoparietal and Sylvian veins (black arrow) (b). Right external carotid artery injection, anteroposterior (c) and lateral views (d), showing a right-sided DAVF fed by the right MMA and draining into the SSS through dilated and tortuous Sylvian veins (black arrows)



**Figure 3:** The operating angle of right external carotid angiogram demonstrating the location of the fistula (black arrow) (a). Scepter C balloon catheter was placed closely to the fistula, then the balloon was inflated between the proximal (white arrow) and distal balloon (black arrow) markers (b). Right common carotid injection, lateral view, demonstrating complete occlusion of the fistula immediately after Onyx-18 injection (c). Lateral skull x-ray (d), right external carotid angiogram (e), and right internal carotid angiogram (f) obtained at 6-month follow-up, showing the vascular casting of Onyx-18 (black arrow) (d), and confirming complete occlusion of the fistula, respectively

## DISCUSSION

In this case, transvenous embolization was not available due to no accessible venous route to the fistulous point. Herein, transarterial embolization appears to be the major option. Although detachable coil could reduce the high flow to assist Onyx embolization, this approach is costlier for dense packing and the stabilization of detachable coils maybe challenging.<sup>[6]</sup> Furthermore, combination of a single-lumen balloon and a conventional microcatheter could lead to the jailing of the microcatheter against the vessel wall that does not completely eliminate Onyx-18 reflux.<sup>[7]</sup> Therefore, we chosen the Scepter-C dual-lumen microcatheter assistance with Onyx-18 to embolize the fistula.

The use of Scepter-C in the treatment of cerebrovascular pathologies has some advantages. The 0.0165-inch inner lumen of Scepter-C allows tracking over a 0.014-inch guidewire which is easier to steer compared to 0.010-inch guidewire, providing more support for distal navigation of the balloon over tortuous vessels. Additionally, Onyx embolization using traditional microcatheter-based techniques needs to form an adequate proximal plug and create a forward flow while preventing retrograde reflux of Onyx and non-targeted occlusion, which is called the

“plug and push technique”.<sup>[8]</sup> However, this technique is often time-consuming and unpredictable process. The Scepter-C device allows the balloon portion of the microcatheter to act as the proximal plug, resulting in decreasing the additional radiation exposure, the risk of microcatheter retention in the cast and hemorrhage from difficulty microcatheter extraction.

There are several drawbacks with the described technique. One disadvantage is the difficulty in navigating the dual-lumen balloon microcatheter into very small distal arterial feeders which can be accessed only with flow-directed microcatheters or small microcatheters. Moreover, the deflation time of balloon is more than 20 seconds to reduce the bubble formation. The newly available Scepter-C balloon microcatheter should be improved to deflate quickly within seconds.

Recently, Scepter-C has been successfully used in neurointerventional management of various pathologies.<sup>[9]</sup> However, data regarding their use in the treatment of DAVFs are limited. Here, we describe our experience with Scepter-C balloon-assisted Onyx-18 embolization of a post-traumatic DAVF of the SS. Scepter-C seems to be a time-saving, safe, and effective device for balloon-assisted selective intra-arterial embolization of DAVFs with Onyx-18. We believe, this

technique would particularly be effective in cases with high tortuosity.

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### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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