

## Case Report

# Angiographic change on time interval in traumatic-direct carotid cavernous fistula without venous reflux, and treatment with LVIS stent alone<sup>☆,☆☆</sup>

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## ABSTRACT

Traumatic carotid cavernous fistula (CCF) is usually high flow, direct type and typically manifested by venous hypertension and reflux, therefore it can lead to various neurologic deficit as well as severe ophthalmic symptoms including exophthalmos, congestion and visual disturbance. On the contrary, in traumatic-direct CCF without high flow that causes venous hypertension and/or reflux, the natural clinical course is obscure, and the diagnosis may be difficult. The treatment has not been well documented in detail. We are reporting on sequential angiographic change on time interval in traumatic-direct CCF without venous hypertension and/or reflux, and experience of treatment using LVIS stent.

## 1. Introduction

Carotid-cavernous fistula (CCF) results from an abnormal arteriovenous communication between the carotid artery and cavernous sinus. CCF is classified according to blood flow characteristics and causes, which can be divided into low flow or high flow, traumatic or spontaneous, direct or indirect. The direct type is a form in which the internal carotid artery (ICA) itself has an abnormal connection with the cavernous sinus and is usually caused by head trauma (violence, falls, car accident or iatrogenic) [1]. In the traumatic direct type, a traumatic tear in the wall of the internal carotid artery usually makes a high pressure conduit to the cavernous sinus, which usually leads to venous hypertension and reflux within a short time interval. Therefore, symptoms are usually presented within days after injury of ICA. When a traumatic-direct type does not show initial symptoms such as exophthalmos, congestion or visual disturbance due to low flow, which does not cause venous hypertension or reflux, the diagnosis may be difficult and in such cases the natural course and management plan has not been so well reported in the literature. We experienced two cases of direct CCF without venous reflux and confirmed the contradictory angiographic changes in time interval in each case. In addition, we report our experience on the use of with Low-profile Visualized Intraluminal Support (LVIS) device in early-onset, non-symptomatic traumatic-direct types CCF.

## 2. Case reports

## 2.1. Case 1

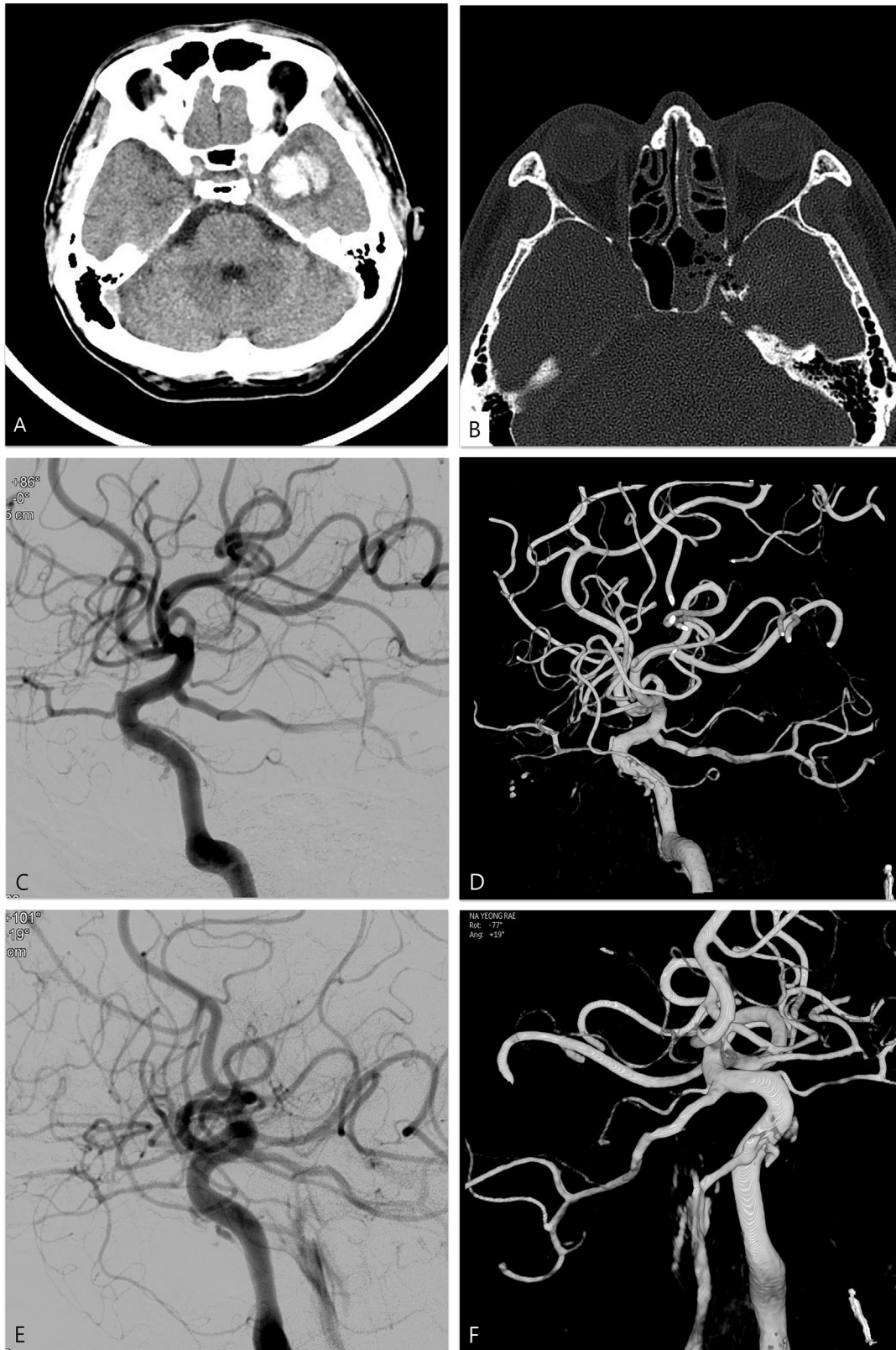
A 45-year-old male was transferred to our hospital after a penetrating injury by a steel rod while working. As the patient slipped, the steel rod had penetrated the skull base through the nose. He had facial pain, headache and decreased consciousness. Neurological examination showed drowsy consciousness and oculomotor, abducens nerve palsy on the ipsilateral side. Computerized tomography (CT) scan revealed intracerebral hemorrhage in the left temporal lobe with central skull base fracture, especially a lateral wall fracture of the sphenoid sinus on the left side (Fig. 1A and B). There was no enlargement of ophthalmic vein nor ocular symptoms suggesting CCF, but considering the type, site of injury and accompanying cranial nerve injury, vascular evaluation was performed. Conventional angiogram defined a very low flow, small leakage from cavernous portion of ICA, but there was no reflux into the draining vein such as the ophthalmic vein (Fig. 1C and D). Initially, active management was not considered because, despite being a direct type of CCF, there was no venous reflux causing ophthalmic vein enlargement nor any overt symptoms. In follow up angiogram one week later, flow velocity had increased and the amount of leakage was more aggravated (Fig. 1E and F). Over time, the lesion was thought to be worse, and active treatment was considered. In a CCF without reflux, total occlusion of Cavernous sinus via a trans-venous approach was considered inappropriate. Selection of fistula portion of microcatheter

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**Fig. 1.** A. Initial CT scan revealed traumatic ICH in the left temporal lobe.  
 B. Bone setting image of CT showed central skull base fracture, especially lateral wall fracture of sphenoid sinus on left side.  
 C and D. Conventional angiogram defined very low flow and small leakage from cavernous portion of ICA, but there was no reflux of draining vein such ophthalmic vein.  
 E and F. In follow up angiogram of one week later, flow velocity was more faster and amount of leakage was more aggravated.  
 G. LVIS stent was deployed in fistula portion.  
 H. After 10 min, complete occlusion of fistula was achieved.

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