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Magnetic resonance angiographic demonstration of carotid-cavernous fistula using elliptical centric time resolved imaging of contrast kinetics (EC-TRICKS)

Surjith Vattoth[a,*], Jıgımon Cherian[a], Tarun Pandey[b]

[a]*Clinical Radiology, Al Sabah Hospital, Ministry of Health, P.O. Box 4078, 13041 Safat, Kuwait*
[b]*Department of Radiology, Al Razi Hospital, Ministry of Health, Kuwait*

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Abstract

Magnetic resonance angiographic evaluation of the intracranial vasculature has been predominantly carried out using conventional angiographic techniques such as time of flight and phase contrast sequences. These techniques have good spatial resolution but lack temporal resolution. Newer faster angiographic techniques have been developed to circumvent this limitation. Elliptical centric time-resolved imaging of contrast kinetics (EC-TRICKS) is one such technique which has combined the use of elliptical centric ordering of the *k*-space with multiphase 3D digital subtraction MR angiogram (MRA) to achieve excellent temporal resolution of the arterial and venous circulations. Its applications have been mainly in the peripheral vasculature. We report the use of this technique in a case of a high-flow, direct carotid-cavernous fistula to demonstrate its potential in intracranial MR angiography.

Keywords: Magnetic resonance angiography; Time-resolved imaging; 3D

1. Introduction

Carotid-cavernous fistula (CCF) is a fistulous communication between the carotid artery or its branches and the cavernous sinus. This may be either a direct (Type A) communication between the internal carotid artery and the cavernous sinus or an indirect communication (Types B–D) between the dural branches of the carotid arteries and the cavernous sinus [1]. The gold standard for making the diagnosis is digital subtraction angiography (DSA). Routine CT and MR imaging including CT and MR angiograms may show the abnormalities and indirect signs of a CCF such as enlarged cavenous sinus, superior ophthalmic vein, petrosal sinuses, or other enlarged tributaries of the cavernous sinus, but direct visualization of the communication is difficult using these noninvasive modalities due to their lack of temporal resolution.

MRA using elliptical centric time-resolved imaging of contrast kinetics (EC-TRICKS) has the ability to time resolve the arterial and venous phases and has been in use for sometime for peripheral and visceral angiograms with success [2,3]. This sequence has also been used for extracranial carotid circulation [4]. Recently, few articles have been published in the literature about the emergence of EC-TRICKS for intracranial angiography [5,6]. However, its role in the demonstration of high-flow direct CCFs has not been described before. We report a case in which we successfully demonstrated the use of EC-TRICKS to show a high-flow direct CCF.

2. Case report

A 23-year-old female patient presented with intermittent left eyelid swelling since 1 year. The patient, a diagnosed case of cerebral palsy, was mentally retarded and was put on supportive care. On clinical examination of the eye, there were bluish spots on the left sclera. The neurological examination was consistent with features of cerebral palsy and the neurologist asked for an MRI evaluation of the brain and orbit. MRI was performed using the GE Signa 1.5-T MRI equipment (GE Medical Systems, Milwaukee, WI, USA).

Routine MRI sequences of the brain were first performed using an eight-channel head coil. The whole procedure was performed with the patient in general anaesthesia as she was

* Corresponding author. Tel.: +965 9453955.
E-mail address: drsurjith@yahoo.co.uk (S. Vattoth).

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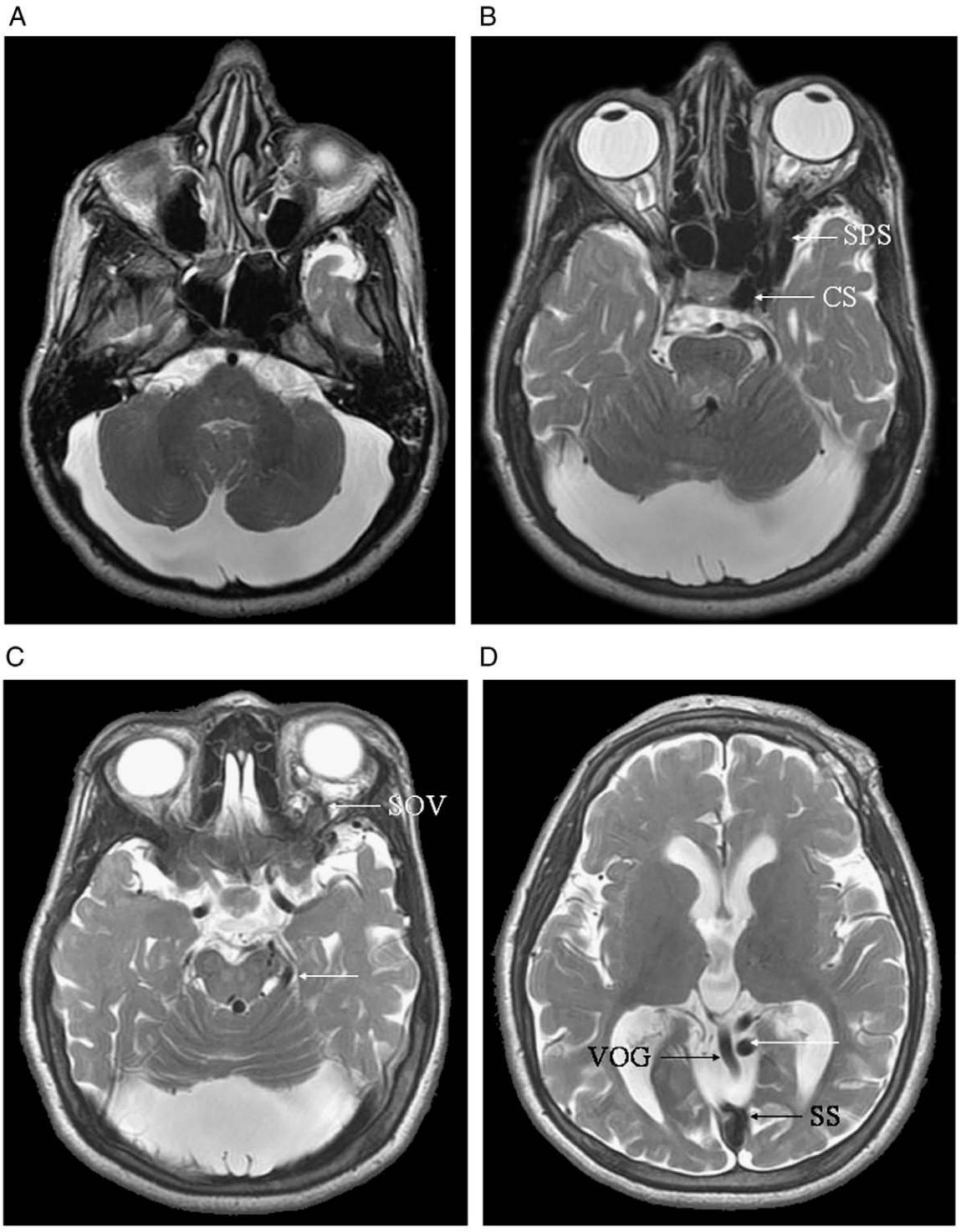

Fig. 1. (A) Axial T2-weighted image (T2WI) showing the retrocerebellar arachnoid cyst and the hypoplastic cerebellum. (B) Axial T2WI showing mild left proptosis, prominent left cavernous sinus (CS) and left sphenoparietal sinus (SPS). (C) Axial T2WI showing the enlarged left superior ophthalmic vein (SOV) and the abnormal left perimesencephalic vascular channel (arrow). (D) Axial T2WI showing the enlarged vascular channel (white arrow) as shown in (C) coursing posterosuperiorly to join the enlarged vein of Galen (VOG) draining into the straight sinus (SS).

mentally retarded. The MRI showed a retrocerebellar arachnoid cyst with cerebellar hypoplasia (Fig. 1A) and mild cerebral atrophy. There was mild left proptosis with prominent left cavernous sinus and flow voids extending to the region of the sphenoparietal sinus (Fig. 1B). The pituitary gland appeared hyperplastic. Tortuous flow void of the left superior ophthalmic vein was seen and there was a prominent vascular channel in and around the perime-