Arterial Spin-labeling Imaging at 3-T in Dural Arteriovenous Fistulas of Cavernous Sinus before and after Endovascular Treatment

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ABSTRACT

A 72-year-old man presented with chemosis and ophthalmoplegia due to dural arteriovenous fistulas (DAVF) of the cavernous sinus (CS). Preoperative arterial spin-labeling (ASL) image showed visible vein in the bilateral superior ophthalmic vein (SOV). Endovascular transvenous embolization of the shunting points of the CS-DAVF was performed, and the postoperative angiogram showed complete obliteration of the CS-DAVF. Postoperative ASL showed no visible vein in the bilateral SOV. ASL in CS-DAVF was proved to have shown retrograde venous drainage from the CS-DAVF by comparing ASL before and after treatment.

Key words: *Arterial spin labeling, Cavernous sinus, Dural arteriovenous fistulas, Endovascular treatment*

In magnetic resonance (MR) imaging of dural arteriovenous fistulas (DAVF) of the cavernous sinus (CS), contrast-enhanced time-resolved MR angiography enables direct demonstration of CS-DAVF, and T2-weighted MR imaging in CS-DAVF with retrograde venous drainage into the superior ophthalmic vein (SOV) may show prominent flow voids due to dilated SOV[3,5]. On the other hand, arterial spin-labeling (ASL) is a non-invasive technique used to acquire information about cerebral blood flow (CBF) in MRI, and it is unknown how ASL shows CS-DAVF. We report ASL at 3T in CS-DAVF before and after endovascular treatment.

CASE REPORT

A 72-year-old man presented with bilateral chemosis and slight ophthalmoplegia. The patient was examined with a clinical 3-T MR unit (Signa EXCITE HD 3.0T; GE Medical Systems, Milwaukee, Wisc, USA) using an 8-channel brain phased-array coil. A pulsed continuous ASL method was applied. ASL was performed by 3D FSE spiral. The imaging parameters were as follows: TR, 4521 ms; TE, 9.8 ms; TI, 1525 ms; slice thickness, 4 mm; gap, 0 mm; FOV, 240 mm; BW, 62.5 kHz;

matrix size, 512 (point) × 10 (arms); 2 NEX; 30 slice; total acquisition time, 3 min 10 s. ASL images were created using a 3DASL in Functool of Signa EXCITE HD 3.0T for perfusion image analysis.

ASL showed visible vein in the bilateral SOV (Fig. 1). The preoperative angiogram revealed the
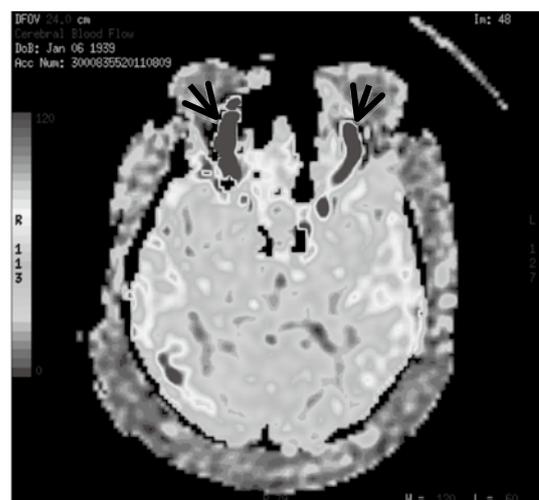
Fig. 1. Preoperative ASL showed visible vein in the bilateral SOV (arrow).

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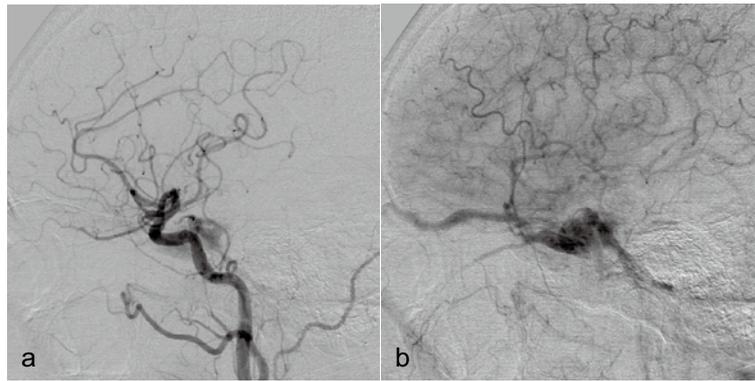
Fig. 2. The arterial phase (a) and capillary phase (b) of lateral view of the DSA before treatment revealed the right CS-DAVF with retrograde venous drainage into the bilateral SOV.
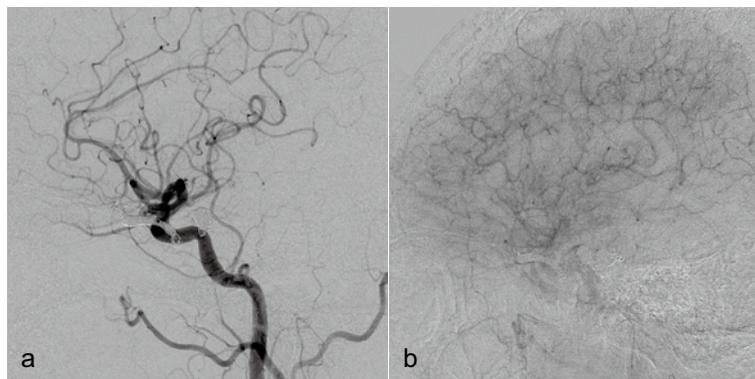
Fig. 3. The arterial phase (a) and capillary phase (b) of lateral view of the DSA after treatment showed complete obliteration of the CS-DAVF.
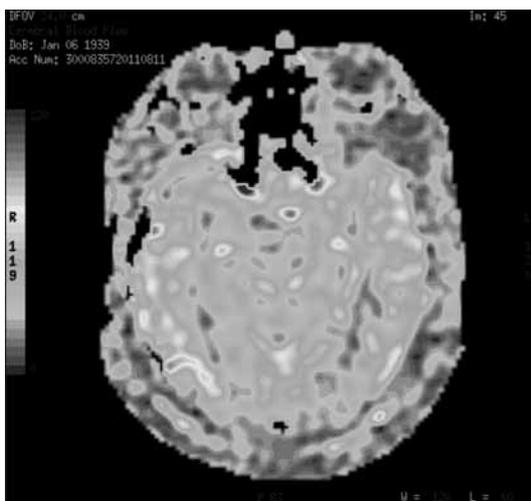
Fig. 4. Postoperative ASL showed no visible vein in the bilateral SOV.

right CS-DAVF with retrograde venous drainage into the bilateral SOV (Fig. 2a and b). Endovascular transvenous embolization of the shunting points of the CS-DAVF was performed, and the postoperative angiogram showed complete obliteration of the CS-DAVF (Fig. 3a and b). ASL, one day after embolization, showed no visible vein in the bilateral SOV in comparison with ASL before treatment (Fig. 4).

DISCUSSION

ASL is a non-invasive technique used to acquire CBF information in MRI[1,2]. ASL is capable of demonstrating hypoperfusion or hyperperfusion in a clinical population[1,2]. ASL is sensitive for depicting hyperperfusion in a number of conditions related to strokes, tumors, seizures, or loss of autoregulatory functions of blood vessels[1,2]. Furthermore, ASL in DAVF has been recently reported, and DAVF of transverse-sigmoid (TS) sinus with retrograde cortical venous drainage (RCVD) using ASL was evaluated. Although the exact mechanism of RCVD signal on ASL is unknown, ASL showed the dilated and very slow veins on the surface of the brain in the affected hemisphere. It was concluded that ASL could detect RCVD in patients with TS sinus DAVF[4]. However, ASL of CS-DAVF before and after treatment has not been reported. Therefore, it is unknown how ASL shows CS-DAVF.

In the present case, preoperative ASL showed

visible vein in the bilateral SOV. Postoperative ASL showed no visible vein in the bilateral SOV. By comparing ASL before and after treatment, ASL at 3T in CS-DAVF was proved to have shown retrograde venous drainage from CS-DAVF. ASL was proved to have shown retrograde veins in the skull base in the same way as retrograde veins on the surface of the brain. ASL could be a useful screening tool to confirm persistent obliteration following definitive treatment in CS-DAVF.

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