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## Symptomatic jugular venous reflux with dilatation of the superior ophthalmic vein mimicking cavernous dural arteriovenous fistula

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## Case Report

# Symptomatic jugular venous reflux with dilatation of the superior ophthalmic vein mimicking cavernous dural arteriovenous fistula

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## ABSTRACT

We report a case of symptomatic jugular venous reflux (JVR) with dilatation of left superior ophthalmic vein (SOV), mimicking cavernous dural arteriovenous fistula (AVF). Severe JVR was caused by an AVF for hemodialysis access and the narrowing of the left brachiocephalic vein. In-flow signals were found from the left internal jugular vein to left SOV on magnetic resonance angiography, and T1-weighted image and T2-weighted images demonstrated flow voids in bilateral sigmoid sinuses and confluence of sinuses due to rapid retrograde venous flow. We would like to emphasize that the presence of in-flow signals/flow voids in the venous sinuses may be the key imaging clues to distinguish JVR with dilatation of the SOV from cDAVF.

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## Introduction

Jugular venous reflux (JVR) is a physiologic phenomenon, which is caused by extrinsic compression of the brachiocephalic vein, leading to stagnation or reflux in the internal jugular vein (IJV). JVR is typically asymptomatic. Retrograde venous flow by JVR is demonstrated on time-of-flight magnetic resonance angiography (TOF-MRA) and may mimic cavernous dural arteriovenous fistula (cDAVF), which is pathologic and can cause not only retrograde venous flow as well as JVR, but also ocular proptosis, chemosis, papillary edema, oculomotor palsy, loss of visual activity, ocular hypertension, and headache. It is clinically important to differentiate JVR from cDAVF, and it is well known that JVR does not cause dilatation of the superior ophthalmic vein (SOV), which in contrast is common in cDAVF [1]. Here, we report a JVR case presenting the SOV dilatation with much increased retrograde venous flow, due to left arm

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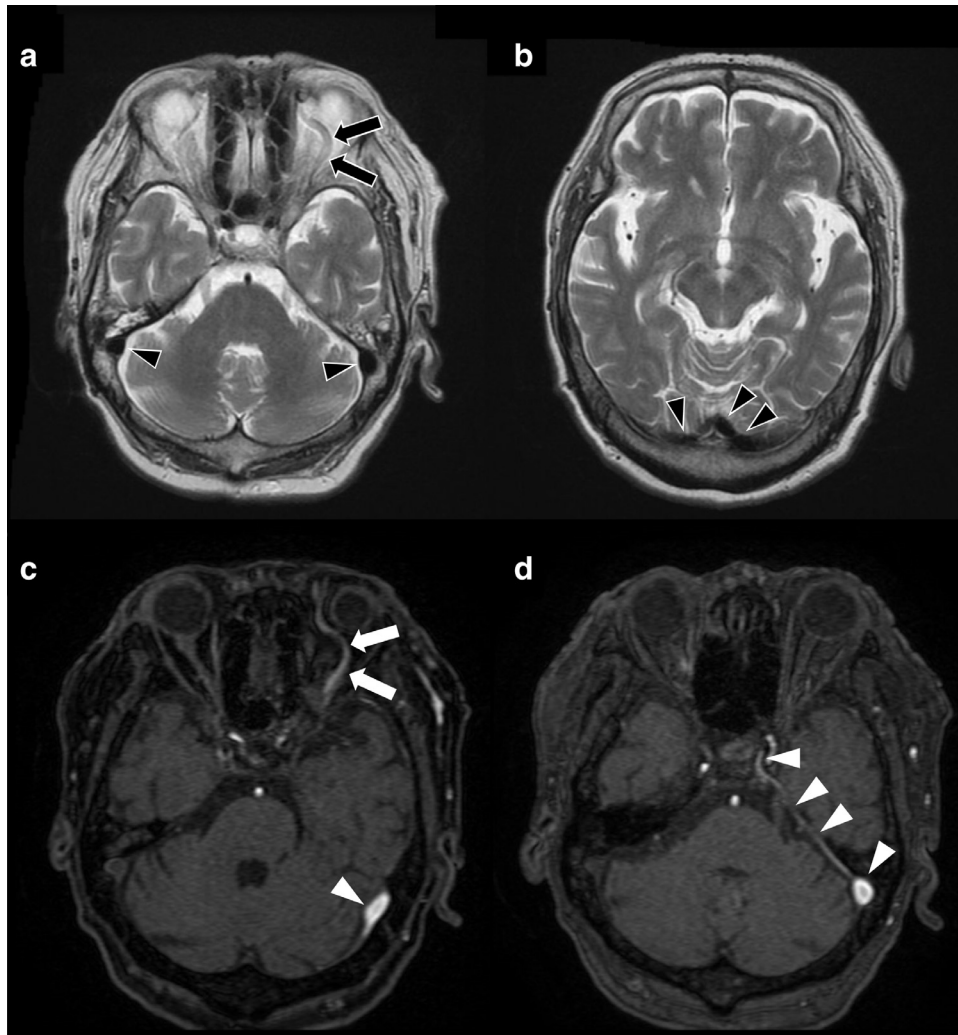
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**Fig. 1 – (a, b) Initial T2WI shows dilated left superior ophthalmic vein (SOV) (black arrows), which is commonly observed in cavernous dural arteriovenous fistula (cDAVF). Bilateral sigmoid sinuses (SS) and the confluence of the sinus are demonstrated as flow voids (black arrow heads), indicating rapid venous flow. (c, d) Time of flight (TOF)-MRA shows in-flow signals at the left SS, inferior petrosal sinus (IPS), and cavernous sinus (CS) (white arrow heads). Left SOV also demonstrates increased signal (white arrows).**

arteriovenous fistula (AVF) for hemodialysis, and discuss the imaging clues to distinguish such JVR case from cDAVF.

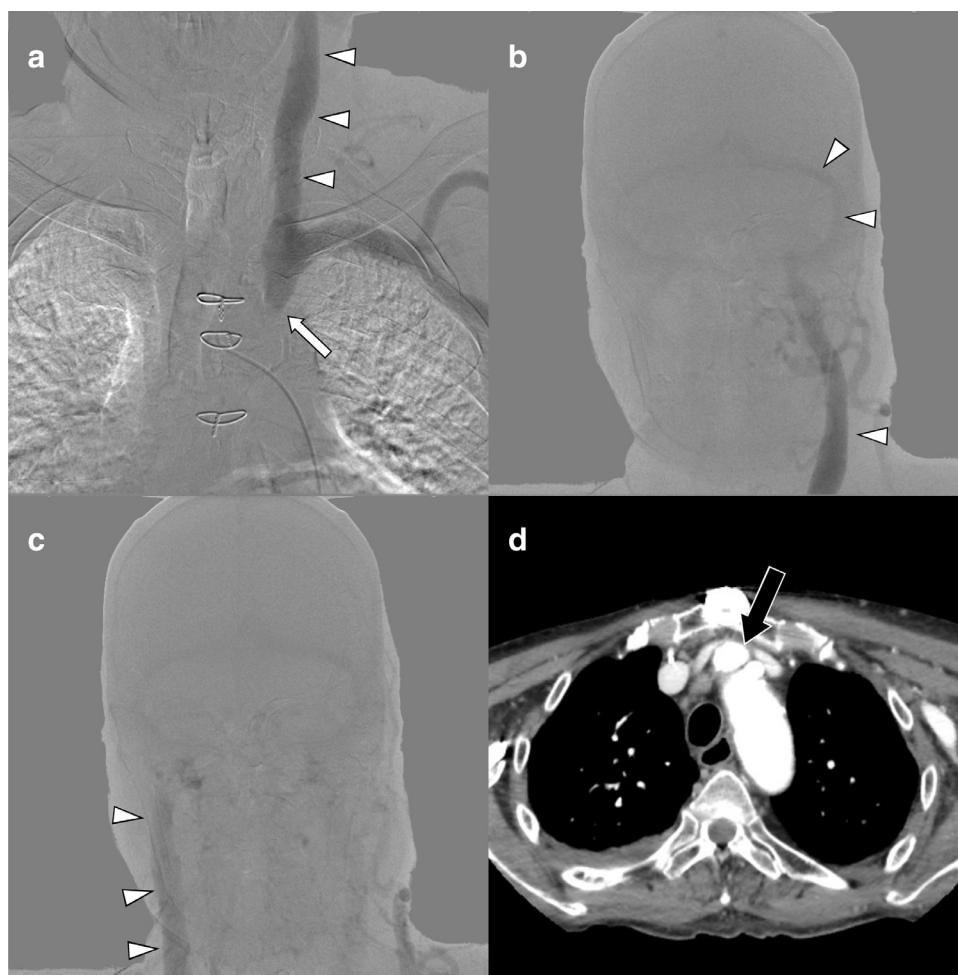
### Case presentation

A 62-year-old male was referred to our hospital because of visual disturbance of the left eye. He had a history of coronary artery bypass graft and denied any head and neck surgery or trauma. He had been undergoing hemodialysis using a left arm AVF. He denied proptosis. Ophthalmological examination revealed bilateral papilledema. History and physical examinations as well as routine labs were unremarkable except for renal dysfunction.

Head MRI demonstrated dilated left SOV on T2WI (Fig. 1a and b) and in-flow signals in left cavernous sinus and SOV suggesting cDAVF on TOF-MRA (Fig. 1c and d). Flow signals were

also seen in left sigmoid sinus (SS), left transverse sinus, left inferior petrosal sinus, and these sinuses demonstrated flow void on T2WI, which are not common in cDAVF. No abnormal vessels or collaterals due to DAVF were identified.

Left internal and external carotid angiography demonstrated no evidence of DAVF; however, venous phase of left subclavian angiography (Fig. 2a and c) demonstrated stenosis of the left brachiocephalic vein interfering with venous drainage to the superior vena cava, which resulted in the retrograde venous flow in the left IJV. The reflux flow subsequently passed through the left SS, transverse sinus, inferior petrosal sinus, cavernous sinus, and SOV and continued to the right IJV. A contrast-enhanced CT demonstrated the heavily compressed left brachiocephalic vein between the repaired sternum and right brachiocephalic artery (Fig. 2d). Thus, we concluded that the symptom and the imaging findings were caused by severe JVR, where the AVF in the left arm much increased venous flow and gained the venous pressure in left IJV,



**Fig. 2 – (a) Venous phase of left subclavian arteriography shows left brachiocephalic vein stenosis (white arrow), which interferes with the venous drainage to the superior vena cava and turns it to the left internal jugular vein (IJV) (white arrow heads). (b, c) The retrograde venous flow passes through left SS, TS, IPS, CS, and back to the right IJV (white arrow heads). (d) Contrast-enhanced CT shows a heavily-narrowed brachiocephalic vein between the sternum and the right brachiocephalic artery (black arrow), which may interfere with the normal venous drainage of the SVC.**

so that the retrograde venous flow could reach and enlarge left SOV, enough to cause the symptom.

The left arm AVF for hemodialysis access was closed and revised to the other side to reduce drainage flow to the left subclavian vein. The symptom and imaging findings disappeared within a week (Fig. 3). After discharge, he remains symptom free with no radiological evidence of recurrence.

## Discussion

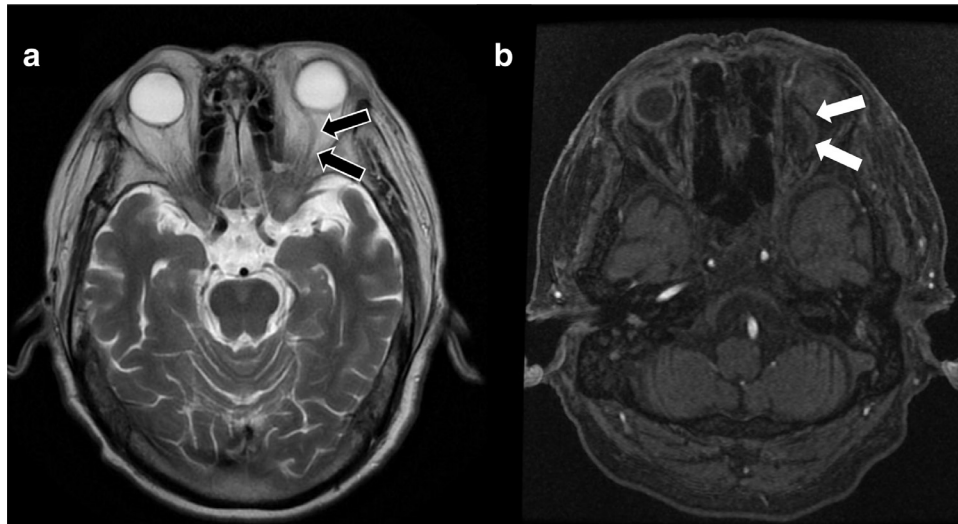
JVR has been regarded as a physiologic phenomenon with the incidence of 1.3%-6.2% [1]. Recent studies, however, suggested that JVR might be related to some neurologic symptoms, such as transient global amnesia or transient monocular blindness [2].

In JVR patients, the retrograde venous flow caused by a compressed brachiocephalic vein results in a caudocranial direction of flow, which leads to in-flow signals at venous si-

nuses on TOF-MRA. In-flow signals in venous sinuses are also observed in cDAVF on TOF-MRA. Because it is essential to distinguish JVR from cDAVF, several imaging clues for differentiation have been proposed [1,3].

Kim et al reported that no JVR cases showed the SOV dilatation [1], since SOV is too far from the brachiocephalic vein for the physiologic reflux flow to reach there and to enlarge it. In the present case, however, the AVF in the left arm and the severe narrowing of brachiocephalic vein yielded much increased retrograde venous flow which was enough to reach and to dilate the left SOV. Our literature search did not uncover any similar cases.

Tanaka et al reported that 73% of JVR cases demonstrated increased signal at the ipsilateral IJV and SS on T2WI, while only 4% of cDAVF cases did [3]. It is thought that normal craniocaudal flow and reflux flow confluence at the IJV and SS, which cause flow stagnation there and results in increased signal in JVR cases. On the other hand, it is rare in cDAVF cases that retrograde flow affects craniocaudal venous flow there, so ipsilateral IJV and SS usually demonstrate flow void on T2WI



**Fig. 3 – (a) Postoperative T2WI shows improvement of the left SOV dilatation (black arrows). (b) TOF-MRA demonstrates no in-flow signals in the venous sinuses or left SOV (white arrows).**

by *orthodromic* venous flow [3]. In the present case; however, left venous sinuses demonstrated flow voids on T2WI. The velocity of retrograde venous flow was considered to be gained by AVF on his left arm and was much higher than it is in usual JVR cases. Thus, it is supposed that the increased *retrograde* venous flow with high velocity resulted in flow voids in venous sinuses.

Angiography was performed for the diagnosis on the present study, since we could not exclude cDAVF or cervical AVF. However, it may be possible to distinguish JVR from cDAVF on MRI and MRA. If the combination of flow void/in-flow signal is noted in the intracranial venous sinuses extensively, it would be more suggestive of JVR rather than cDAVF. In such cases, further evaluation by CT angiography or cervical color-Doppler ultrasonography may enable us to reach the correct diagnosis without angiography.

## Conclusion

JVR is commonly a physiologic phenomenon; however, one should be aware that JVR may mimic cDAVF with similar

symptom and dilatation of the SOV due to increased retrograde venous flow, especially when the AVF for hemodialysis is on the left arm. It is important to carefully interpret MRI and MRA for the differential diagnosis of these 2 different entities presenting with dilatation of the SOV.

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