Dural arteriovenous fistula (DAVF) is an abnormal fistulous connection between the meningeal arteries and dural venous sinuses, meningeal veins, or cortical veins, which account for only 10–15% of all intracranial arteriovenous malformations (AVMs). Although a DAVF can arise anywhere within the dura mater, it preferentially occurs in the transverse-sigmoid and cavernous sinuses. The digital subtraction angiogram (DSA) reveals a dural arteriovenous fistula (DAVF) in the occipito-sigmoid sinus with reflux flow into the straight sinus (Borden Type II). A transvenous embolization and transarterial embolization were performed, in an emergency setting, for the occipital sinus and dural shunt, respectively, with the aim of preserving the antegrade flow of the straight sinus. The DSA following the endovascular treatment showed the disappearance of shunt flow and recovery of the antegrade flow in the straight sinus. Therefore, this case report highlights that meticulous analysis of MRI scans help diagnose DAVF, which results in quick and radical treatment.

Key words: dural arteriovenous fistula, magnetic resonance imaging, differential diagnosis
small and multiple hypointense spots indicating micro-bleedings in the bilateral thalami and left cerebellar hemisphere (Figure 2A). A time-of-flight (TOF) source image showed small hyperintense dots adjacent to the wall of the occipital and straight sinus (Figure 2B). The DSA revealed a DAVF in the occipital-straight sinus, with retrograde venous flow in the straight sinus (Borden Type II) (Figure 3A-C).

The occipital sinus was occluded by a trans-venous embolization. Further, a trans-arterial embolization for the dural shunt on a straight sinus was performed in an emergency setting, with the aim of preserving the antegrade flow of the

**Figure 1:** Fluid attenuated inversion recovery (FLAIR) and T2-weighted (T2WI) magnetic resonance imaging (MRI) before treatment
Axial FLAIR (A) and T2WI (B) images showed hyperintensity and swelling in the bilateral thalami, medial parietal lobes, and occipital lobes (white arrows). Another axial T2WI (C) delineated the hypointense tortuous vein on the cerebellar surface (white arrow). These findings suggested the presence of venous congestion, which was caused by fistulous reflux flow into the straight sinus.

**Figure 2:** Susceptibility weighted image (SWI) and time-of-flight (TOF) source image before treatment
The SWI (A) revealed multiple small, hypointense dots in the bilateral thalami and right occipital lobe (white arrows). The TOF (B) source image showed multiple nodular hyperintense areas in the sinus wall, which were meningeal branches of feeding arteries and draining venules of the dural arteriovenous fistula (DAVF) (white arrows).
Bi-thalamic oedema due to arteriovenous fistula

Pulsatile tinnitus is a common symptom caused by increased blood flow in the venous system near the middle ear where a high-velocity shunt flow enters\(^7, 13\). Patients with a DAVF can also present with more severe symptoms, including intracranial haemorrhage and non-haemorrhagic neurological deficits, such as seizures, cerebellar symptoms, apathy, cranial nerve impairments, and failure to thrive\(^7\). The wide-range of symptoms occasionally make the clinical diagnosis more difficult.

Symmetrical bilateral thalamic oedema has relatively few differential diagnoses of vascular and non-vascular aetiologies. The most common vascular aetiologies include thromboembolism of the basilar artery and thrombosis of the deep venous system, whereas non-vascular aetiologies are an intrinsic infiltrative tumour and encephalitis\(^17\). Early MRI features in arterial thromboembolism can be seen immediately after the onset. The loss of flow void is clearly revealed on the TOF-MRA, and the thrombus itself can be seen as a hypoin-
tense mass on the SWI\textsuperscript{19}. Hyperintensity in the sinus on the T1WI or FLAIR indicates sinus thrombosis\textsuperscript{17}. A thrombosed sinus was clearly shown on MR venography\textsuperscript{9}. Infiltrative tumour in bilateral thalami is a rare neoplasm\textsuperscript{17}. It is usually a low-grade infiltrative astrocytoma (WHO grade II), which is generally hyperintense on the T2WI and hypointense on the T1WI, without contrast enhancement\textsuperscript{15, 17}. MRI images of encephalitis may reveal bilateral hyperintensity on T2WI in the thalami, basal ganglia, or midbrain\textsuperscript{9}. In some aetiologies of encephalitis, hyperintensity in the sulci on the T2WI has also been reported, which is suggestive of leptomeningeal inflammation\textsuperscript{8, 17}. However, a DAVF involving the deep venous system was also attributed as the aetiology of bilateral thalamic oedema\textsuperscript{9, 17}. An MRI is helpful for the diagnosis of DAVF because it can demonstrate dilated vessels, vascular enhancement, and signs of venous hypertension\textsuperscript{7, 14, 10}. Suspicion of DAVF, based on MRI findings, can lead to the decision to perform a DSA. The T2WI provides a good anatomical overview, and delineates dilated vessels and oedema resulting from venous hypertension and the passive congestion of the vessels and oedema resulting from venous hypertension\textsuperscript{7, 14, 10}. Takada et al.\textsuperscript{18} also reported a case with DAVF involving straight sinus in which T2WI showed hyperintensity in the bilateral thalami.

SWI can depict the acute or chronic haemorrhagic complications of DAVF, including previous haemorrhagic events, such as pial hemosiderosis or chronic intraparenchymal hematoma, which may remain occult on images acquired using other imaging modalities or MR sequences\textsuperscript{11, 12}. Numerous microhaemorrhages, or microbleeds, appear as hypointense spots, predominantly within the cerebral cortex or near the grey−white junction\textsuperscript{12, 13}.

Bink et al.\textsuperscript{2} demonstrated TOF as an important sequence, which was helpful for the detection of fistulous points in DAVF. The TOF source image revealed multiple high-intensity curvilinear or nodular structures in the sinus wall, indicative of feeding arterioles and draining venules involving the fistula. High-intensity areas in the venous sinus suggestive of arterialized high-velocity flow\textsuperscript{10} were also seen in our case.

CONCLUSION

DAVF should be considered as a differential diagnosis in patients with bilateral thalamic oedema on MRI. We recommend careful analysis of MR images, particularly SWI and TOF source images, which helps in providing a quick diagnosis and early treatment of patients with DAVF.

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