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Mixed pial-dural fistula development after ventricular shunting

CASE REPORT

A 36-year-old male was first diagnosed with increased intracranial pressure following persistent headaches 3 years prior to presentation to our centre. A lumbar puncture had revealed elevated opening pressure, and he underwent ventriculo-peritoneal shunting for pseudotumor cerebri.

He presented to our centre due to decreased vision. An MRI was suspicious for a superior sagittal sinus (SSS) dural arteriovenous fistula (dAVF), and confirmed by MRA. He underwent catheter angiography, confirming the dAVF but also a separate mixed pial-dural arteriovenous fistula (p-dAVF) at the catheter (figure 1), which used the diseased SSS segment for outflow. Since transvenous occlusion of this segment was a planned part of his endovascular therapy, the p-dAVF was surgically disconnected first, to avoid p-dAVF outflow occlusion.

Under general anaesthesia and after intravenous mannitol, phenytoin and dexamethasone, a flap was made around the shunt in the semilateral position. The valve and catheter were dissected out, a bone flap raised and the shunt disconnected. The distal catheter and valve were removed. The bone flap was then removed, and the remaining catheter and malformation were then dissected around the complex from the dural supply. The pial arterial supply was then disconnected, after which the draining vein was cauterised. The catheter and then the p-dAVF were then removed. A patch was then sewn into place, the bone flap plated back, the incision closed and dressed, and the patient was taken to the recovery room. He was discharged home 3 days later.

The patient underwent two stages of embolisation of meningeal arteries with N-butyl-cyanoacrylate in order to slow the flow to the dAVF. Under general anaesthesia for the transvenous occlusion, a catheter was used to select the right sigmoid sinus through a common femoral venous sheath. Next, two tandem microcatheters were used to select the mid-SSS across the torcula. Multiple coils were then deployed through the first microcatheter down to the torcula then removed. Through the second microcatheter in the coil mass, Onyx-34 (ev3 neurovascular, Irvine, California, USA) was slowly infused into the coil mass (figure 2) until the dAVF was completely occluded. The patient was discharged home the next day. At 6 months, the patient no longer required shunting, had resolution of his headaches and improvement of his vision, and had no recurrence on angiography.

This case supports the theory that some cranial fistulae are acquired[1] and can rarely be mixed pial-dural.[2] Dural AVFs cause venous hypertension and ischaemia, which may directly elevate vascular endothelial growth factor (VEGF),[3] or indirectly through decreased cerebral perfusion pressure.[4] [5] VEGF promotes angiogenesis and an excessive vascular response to iatrogenic injuries. As ventriculo-peritoneal shunting transgresses dura and cortex, both meningeal and pial arterial supplies were

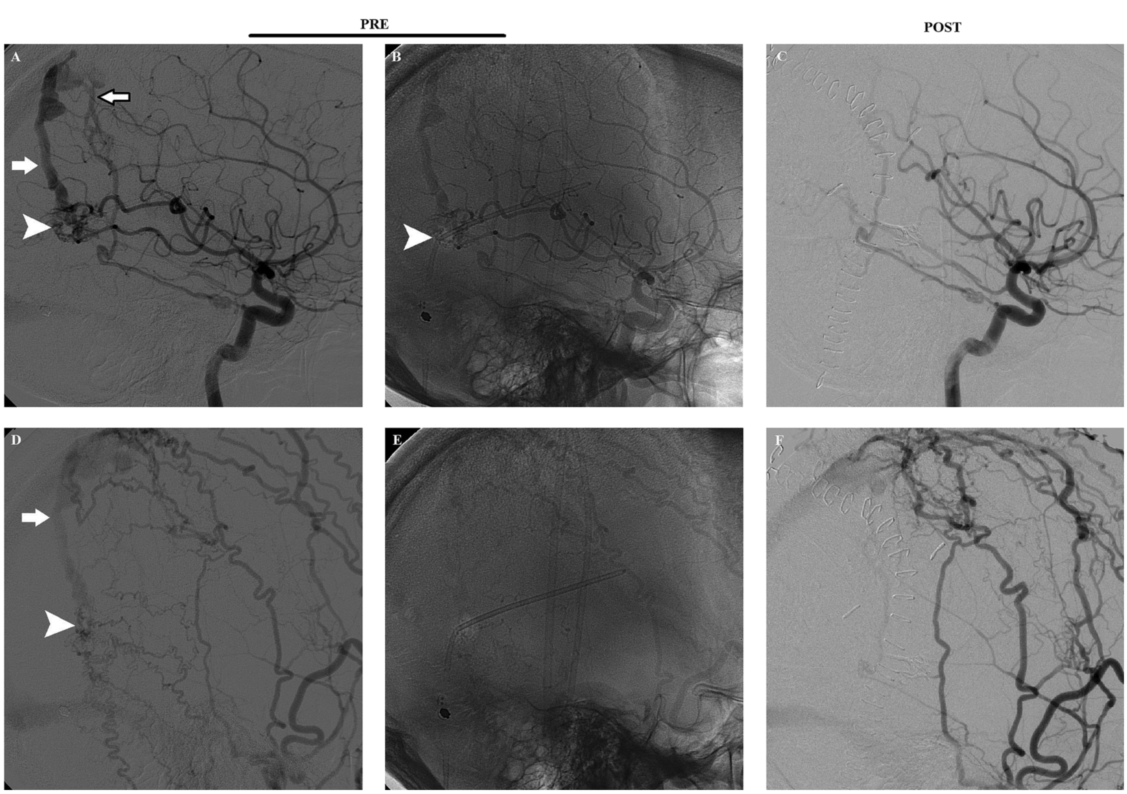

Figure 1 Lateral projection angiography before and after resection of the mixed pial-dural arteriovenous fistula (p-dAVF). Digital subtraction (A) and unsubtracted (B) injection of the right internal carotid artery demonstrates middle cerebral arterial supply to a circular ring-shaped p-daVF around the ventricular catheter insertion point (arrowhead) with venous outflow through a meningeal vein (arrow) emptying into the superior sagittal sinus, with no residual after resection (C). Digital subtraction (D) and unsubtracted (E) injection of the right internal maxillary artery demonstrates middle meningeal arterial supply to the same ring-shaped p-dAVF with no residual after resection (F).

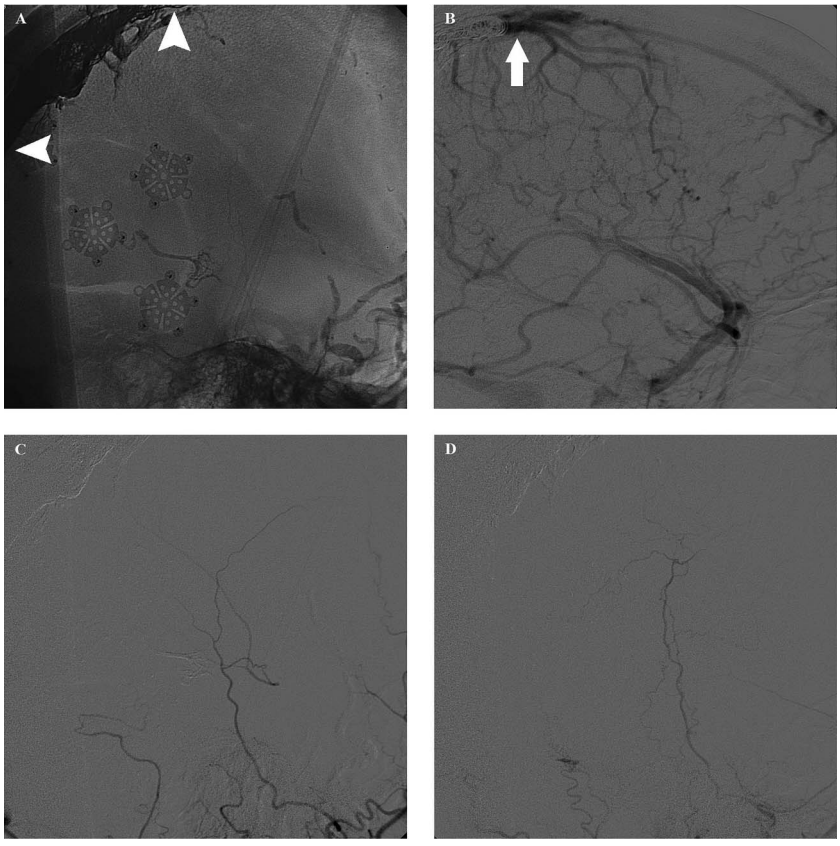

Figure 2 Lateral projection angiography after transvenous occlusion of the fistula with coils and Onyx. Unsubtracted snapshot (A) demonstrates the extent of the diseased superior sagittal sinus (SSS). Late venous phase arteriography from the right internal carotid artery (B) demonstrates patency of the anterior portion of the SSS (arrowhead). Digital subtraction angiography from the right occipital (C) and internal maxillary (D) arteries demonstrates complete obliteration of the fistula.

exposed for recruitment. Unfortunately in this case, the original cranial imaging was unavailable and we are thus unable to determine the exact initial underlying vascular pathology.

CONCLUSIONS

This case stresses the importance of cranial imaging for the evaluation of intracranial hypertension. Intracranial hypertension may be secondary to sinus stenosis, sinus occlusion or dAVF, and early diagnosis can lead to appropriate treatment.

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Notes