CASE REPORT

Transorbital superior ophthalmic vein sacrifice to preserve vision in ocular hypertension from aseptic cavernous sinus thrombosis

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SUMMARY

Aseptic cavernous sinus thrombosis (CST) is rare and may clinically masquerade as a carotid cavernous fistula. Conventional management includes oral anticoagulation, but cases of ocular hypertension affecting vision may require more aggressive intervention. We report a case of a woman with spontaneous bilaterally occluded cavernous sinuses with elevated intraocular pressure (IOP), which resolved immediately following unilateral superior ophthalmic vein (SOV) sacrifice. She was subsequently placed on oral anticoagulants. By 4 months postoperatively her IOP was normalized and her vision had improved. Repeat angiography demonstrated stable venous filling, with some mild improvement of flow through the cavernous sinus. Coil-mediated sacrifice of the SOV might be an effective means to relieve ocular hypertension and preserve vision in the setting of aseptic CST.

BACKGROUND

Aseptic cavernous sinus thrombosis (CST) is rare and may clinically masquerade as a carotid cavernous fistula (CCF).¹ Conventional management includes oral anticoagulation,² but ocular hypertension affecting vision may require more immediate aggressive intervention. We report a case of spontaneous bilaterally occluded cavernous sinuses with elevated intraocular pressure (IOP), which resolved following unilateral superior ophthalmic vein (SOV) sacrifice.

CASE PRESENTATION

A 41-year-old woman with asthma presented with progressive blurred vision and significant loss of left eye peripheral vision, which had acutely worsened that morning. She had a 10-month history of headache, red eyes, and chemosis, previously managed with corticosteroids with recent addition of topical latanoprost. On examination, visual acuity was 20/60 in both eyes, with left relative afferent pupil defect. There was corkscrew dilation of conjunctival vessels with ciliary flush and hyperemia, chemosis, proptosis, and pulsatility on tonometry—left greater than right. Gonioscopy showed an open angle without blood in Schlemm's canal. IOP on the right was 20 mm Hg; left, 49 mm Hg (figure 1). Visual fields demonstrated arcuate defects, left greater than right. Optical coherence tomography demonstrated bilateral thinning of the optic nerve retinal nerve fiber layer, left greater than right. Brimonidine, dorzolamide, and acetazolamide

Figure 1 (A) Preoperative ophthalmologic examination demonstrating proptosis (subtle), chemosis, and redness of the left eye. (B) Magnified view of left eye.

were administered to reduce IOP acutely; β -blockers were not given because of asthma.

INVESTIGATIONS

Ophthalmic findings heightened concern for a dural cavernous fistula so a diagnostic angiogram was ordered. This did not demonstrate a fistula; however, bilateral cavernous sinuses and inferior petrosal sinuses did not fill, with left SOV drainage reversal (figure 2).

TREATMENT

Increased episcleral venous pressure was determined to be the etiology of ocular pathology. SOV embolization to relieve outflow glaucoma and prevent further visual decline was therefore planned. The patient was taken to the neurointerventional suite with the neuroendovascular team the following day. Transfemoral artery access to the left common carotid artery was achieved, providing good visualization of the SOV. SOV exposure was obtained by the orbital surgeon, who also assisted in SOV cannulation. A left orbitotomy was performed through an upper eyelid crease incision with dissection to the supraorbital rim, where the supraorbital vein was identified. Dissection

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Figure 2 (A) Capillary phase of angiogram showing no early venous filling of the superior ophthalmic vein (SOV), which would be seen in the case of carotid cavernous fistula. The ophthalmic artery is seen filling off the internal carotid artery, with some delayed clearing indicative of some drainage obstruction. (B) The proximal SOV is seen in the venous phase (arrow), but without a significant cavernous sinus blush. (C) The SOV continues to have drainage reversal in the late venous phase (arrow), with a continued lack of significant cavernous sinus filling.

proceeded into the mid orbit to isolate a segment of SOV of sufficient caliber to cannulate (figure 3) (note that, unlike CCF, aseptic CST does not have an arterialized SOV and therefore can present some challenge with access). Angiography was used to co-localize the SOV, which was then accessed using a 21 gauge needle, 18 gauge guidewire, and then catheterized with a 4 French dilation sheath. This was connected to a copilot and

secured to the bridge of the nose with steristrips. An Excelsior 1018 microcatheter (Stryker, Fremont, California, USA) was then advanced into the SOV over a Synchro 14 microwire (Boston Scientific, Boston, Massachusetts, USA). Selective microcatheter angiography was performed of the cavernous sinus (figure 3). This demonstrated some limited patency and flow through the left cavernous sinus and petrous segment, with some

Figure 3 (A) Isolated segment of superior ophthalmic vein (SOV) (left) which lacks arterIALIZATION. (B) Fluoroscopic confirmation of its successful cannulation seen behind the 4 Fr sheath exiting the eye. (C) Microcatheter run showing position (short arrow) in proximal SOV as it enters the cavernous sinus. (D) Injection reveals some forced cavernous sinus patency with contralateral filling (long arrow).

contralateral cross-filling. The cavernous sinus was not densely packed given suspicion of some preserved patency. Instead, the SOV was embolized progressively from the posterior segment just proximal to the confluence, proceeding anteriorly using 23 Axiom coils (eV3, Irvine, California, USA). Follow-up angiography demonstrated complete SOV embolization, with some improved flow through the cavernous sinus (figure 4). Catheters were withdrawn, hemostasis was achieved, and the upper eyelid was closed.

OUTCOME AND FOLLOW-UP

Immediately postoperatively her left IOP had decreased to 34 mm Hg and was improving until 5 weeks postoperatively, when the left IOP rose to 19 mm Hg with return of chemosis. Diagnostic angiography demonstrated stable thrombosis of the cavernous and petrosal sinuses with some bilateral filling. She was therefore placed on low molecular weight heparin and bridged to warfarin with close observation. Four months postoperatively the left IOP had decreased to 16 mm Hg, with improved vision of 20/20 OD and 20/50 OS. Repeat angiography demonstrated stable venous filling, with some mild improvement of flow through the cavernous sinus.

DISCUSSION

Aseptic CST is very rare. Septic CST is more common and often presents with fever and possibly signs of sepsis. Symptoms of CST, both septic and aseptic, generally derive from cranial nerve and meningeal irritation. Headache is very common, reported in up to 90% of cases.³ Ocular manifestations are often secondary to venous congestion, and can manifest as chemosis, periorbital edema, and proptosis with disease progression. Visual impairment and extraocular muscle dysfunction can also be observed. CST should be considered in the differential diagnosis based on these clinical signs and symptoms, and confirmed with imaging. On non-invasive imaging, signs of cavernous sinus expansion, irregular filling defects or visualized sinovenous thrombi, SOV dilation, and exophthalmos are all suggestive. Digital subtraction angiography can be used for definitive assessment. Empiric antibiotics are recommended in suspected septic CST.²⁻³ Thrombolysis might be a reasonable option in CST, with a mean recanalization time of 29 h.⁴ Anticoagulation is the definitive treatment.²⁻⁵ However, it may take several months to see clinical benefit.⁶⁻⁷ In this specific case we were most concerned about acutely relieving IOP to save the eye, temporizing the patient for initiation of anticoagulation.

Intracranial venous hemodynamics have significance in ocular health. Orbital venous drainage occurs predominantly through the SOV into the cavernous sinus. In our case, the venous outflow through both the cavernous sinus and inferior petrosal sinus was impaired by presumed thrombosis. This resulted in SOV drainage reversal with orbital congestion, ocular vessel engorgement, and a dramatic rise in IOP. Similar findings are seen in acquired cavernous dural arteriovenous fistulas which cause secondary outflow glaucoma with associated pulsatile exophthalmos, chemosis, conjunctival injection, and episcleral venous dilation. Low-flow dural fistulas may occur when small venous channels become thrombosed and shunting results through the available venous vessels.

More commonly, anteriorization of the SOV flow occurs in CCFs.⁸⁻⁹ The SOV in this case was not dramatically dilated as in a CCF, but it did have reversal of flow like a CCF. CST and the much rarer SOV thrombosis are other etiologies of impaired SOV outflow.¹⁻¹⁰⁻¹³ Transvenous coil embolization of fistulas is often definitive in eliminating the SOV drainage reversal by decreasing high arterial flow.⁸ By a similar mechanism, in the setting of CST, we eliminated SOV hypertension with SOV sacrifice. This reduced IOP while preventing further visual decline. Reduction in ocular symptoms in CCFs via cavernous sinus coil embolization has been described.¹⁴ Similarly, venous sinus sacrifice of dural sinus arteriovenous fistulas is a reported method for reducing cortical venous reflux by reversing the flow gradient.¹⁵

Aseptic CST is very rare, usually a result of trauma or surgery.¹ No such factors were present in our patient. However, she had been on an estrogen patch for hormone replacement after bilateral salpingo-oophorectomy, which may increase hypercoagulability. The fact that her symptoms began upon awakening suggests venous stasis as a contributor. She was placed on prolonged oral anticoagulation, recommended in cases of aseptic dural sinus thrombosis.²

In uncomplicated cases of aseptic CST, conservative management would be reasonable. Rarely, aseptic CST may even resolve spontaneously.¹³ However, our decision to sacrifice the SOV was based on our patient's threatened vision and urgent need to prevent further visual decline secondary to elevated IOP. This was a temporizing measure to preserve vision before the decision to anticoagulate was made. Our intervention resulted in significant IOP reduction and improvement of vision.

Figure 4 (A) Complete coil embolization of the superior ophthalmic vein (SOV) is seen. There is also some improved filling of the cavernous sinus after direct cannulation and injection (arrow). (B) Unsubtracted fluoroscopic view of the coil mass in the SOV.

Learning points

- ▶ Aseptic cavernous sinus thrombosis (CST) is very rare, is usually a result of trauma or surgery, and can clinically masquerade as a carotid cavernous fistula.
- ▶ Dilated and tortuous episcleral vessels are the hallmark of increased venous pressure, which leads to secondary glaucoma.
- ▶ Sacrifice of the superior ophthalmic vein might be an effective means to relieve ocular hypertension and preserve vision in the setting of aseptic CST.

Competing interests JM is a consultant for Lazarus Effect, Medina Medical, Pulsar Vascular, Reverse Medical, and Edge Therapeutics; an investor in Blockade Medical and Medina Medical; and is on the advisory board for Codman Neurovascular.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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