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CASE REPORT

Antegrade rheolytic thrombectomy and thrombolysis for superior sagittal sinus thrombosis using burr hole access

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SUMMARY

Superior sagittal sinus (SSS) thrombosis has high morbidity and mortality, and urgent recanalization is critical for severe cases. Standard endovascular techniques for thrombolysis and thrombectomy use retrograde venous access, an approach that may be unsuccessful in cases with extensive firm clot burden involving the dural sinuses distal to the SSS. An anterior open transcranial approach to the SSS for catheter sheath placement to facilitate antegrade mechanical thrombectomy and thrombolysis of the SSS and more distal sinuses has not been previously described. Here we describe a case in which multiple unsuccessful attempts at retrograde endovascular access were attempted. Thus, a burr hole over the anterior SSS was performed for daily endovascular antegrade procedures using the Angiojet rheolytic catheter device and chemical thrombolysis. Near-complete recanalization of the SSS was achieved with venous outflow via dilated left transverse and left sigmoid sinuses, along with significant collateral flow in multiple cerebral veins.

BACKGROUND

Intracranial dural sinus thrombosis can result in intracranial hemorrhage, stroke and elevated intracranial pressure producing permanent disability. Clinical presentation varies from simple headaches to coma and death. In urgent cases, superselective infusion of thrombolytics into the occluded sinus can be effective[1 2] and should be considered for deteriorating patients, even in the setting of intraparenchymal hemorrhage.[3] Endovascular mechanical thrombectomy is also effective in severe cases with tenacious thrombus or extensive clot burden.[4 5] Open surgical intervention is rarely considered in severe cases of extensive sinus thrombosis, and the literature on this treatment strategy is limited.[6–8]

Endovascular access is typically achieved via the jugular veins, but this is ineffective if there is significant jugular bulb thrombus. We describe a patient with extensive dural sinus thrombosis managed with neurosurgical access to the anterior superior sagittal sinus (SSS) for antegrade rheolytic thrombectomy and chemical thrombolysis.

CASE PRESENTATION

A 51-year-old woman with hypothyroidism and menometorrhagia presented with progressive headache, hemianesthesia, hemiparesis and aphasia.

INVESTIGATIONS

CT scan showed bifrontoparietal intraparenchymal hemorrhages and hyperdensity of the SSS (figures 1A, B); CT and MR venography (figures 1C, D) confirmed SSS thrombosis involving the torcula and right transverse sinus. The left transverse sinus was congenitally hypoplastic.

TREATMENT

A lumbar puncture showed an opening pressure of 48 cm H_2O. A lumbar drain was placed and a systemic heparin infusion was initiated.

Femoral vein access was used to catheterize the right internal jugular vein to the level of the jugular bulb; retrograde venography demonstrated thrombus filling the right jugular bulb, sigmoid sinus, transverse sinus and torcula (figure 2A). Multiple microcatheter and micro guidewire attempts to catheterize the right sigmoid and transverse sinuses were unsuccessful due to dense clot. Chemical thrombolysis of the right jugular bulb was unsuccessful (2 mg tissue plasminogen activator (tPA)); given the limited access, mechanical thrombectomy was not attempted. The left jugular bulb, sigmoid sinus and transverse sinuses were patent but congenitally quite small and the torcular thrombus was firm. Venous and arterial sheaths were left in place and systemic heparinization continued.

After 4 days of intravenous heparin therapy, the lumbar pressure rose and the patient was brought to the operating room. A linear midline sagittal incision was made behind the hairline and a burr hole was placed over the anterior SSS at the level of the coronal suture. The dural sinus 'roof' was opened and dense clot was evacuated from the anterior SSS via suctioning. A Foley catheter was passed into the mid and posterior SSS with intermittent gentle suction, resulting in partial thrombectomy. A 7 Fr endovascular sheath was secured in the SSS directed posteriorly and the incisions were closed (figure 2B).

Under fluoroscopic guidance, a 5 Fr Glidecath (Terumo Medical Corp, Somerset, New Jersey, USA) was placed through the 7 Fr sheath and manipulated into the right transverse and sigmoid sinuses. Sinography via the Glidecath demonstrated thrombus within the jugular bulb. Multiple attempts to pass through the thrombus using guidewires were unsuccessful, and the Glidecath was left in the distal sigmoid sinus. A High-flow Renegade catheter (Boston Scientific, Natick, Massachusetts,

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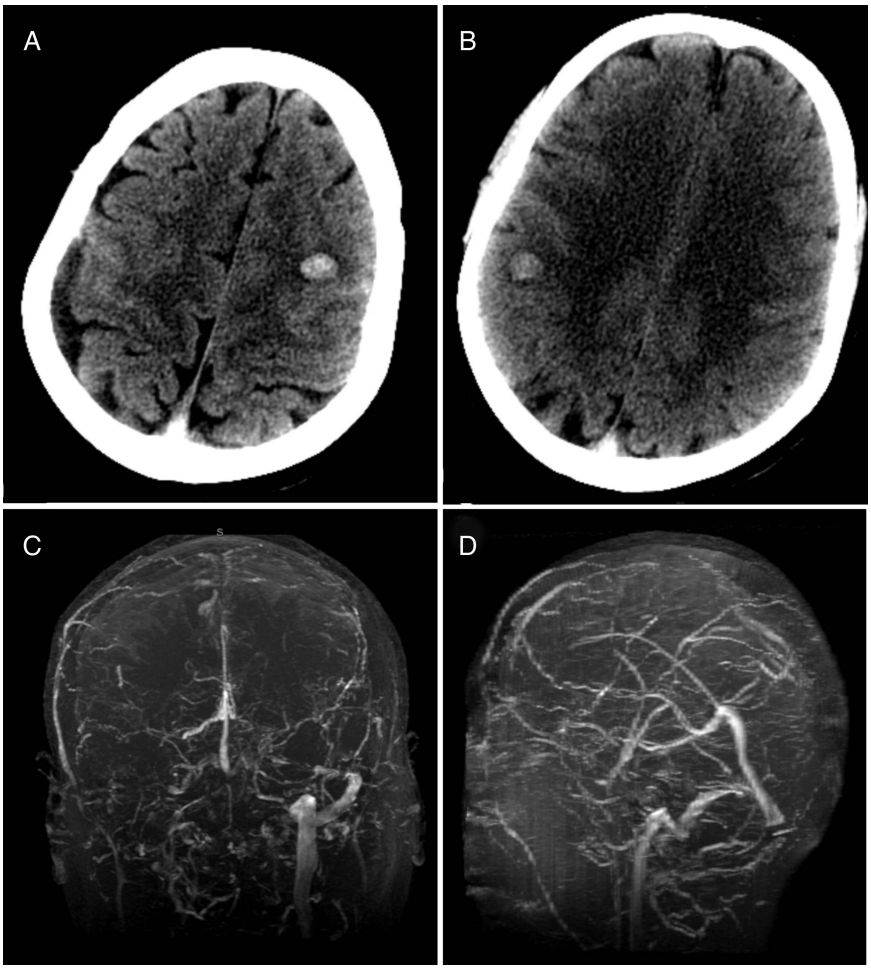

Figure 1 Initial non-contrast CT demonstrates left frontal (A) and right frontoparietal (B) parenchymal hemorrhages and increased attenuation of the superior sagittal sinus due to dense thrombus. MR venography of the dural venous sinuses (C, D) confirms occlusion of the superior sagittal sinus, right transverse sinus and right internal jugular bulb.

USA) was manipulated into the bulb for tPA infusion at 0.25 mg/h (9 mg over 18 h).

The next day, a Boston Scientific Synchro-2 0.014 inch guidewire was placed through the Glidecath and replaced with a 4 Fr Angiojet Spyproflex rheolytic catheter (Medrad, Warrendale, Pennsylvania, USA). Multiple thrombectomy passes were performed. Venography demonstrated increased SSS flow and improved patency of the torcula, flow out of the left transverse and sigmoid sinuses, contrast filling of the right transverse sinus and filling of multiple cerebral veins. A multi-hole perfusion catheter was placed with catheter holes spanning from the posterior fontanel to the jugular bulb with subsequent tPA infusion (9 mg).

Repeat arteriography and sinography demonstrated a normal SSS from the posterior fontanel to the torcula and an increase in the left transverse and sigmoid sinus diameters. Anterior SSS flow was decreased relative to the previous study, but improved relative to pre-thrombectomy. Additional tPA was infused (9 mg). One day later there was complete opacification of the SSS after the catheter was removed and excellent collateral

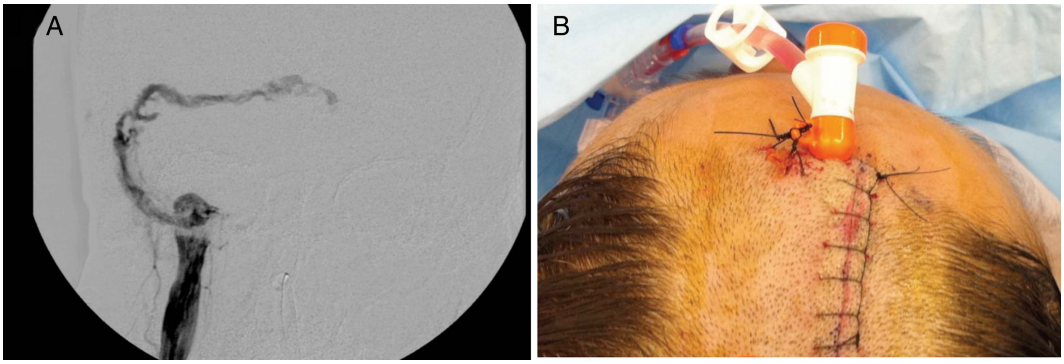

Figure 2 (A) Anteroposterior projection during contrast injection at the right internal jugular bulb demonstrates dense irregular thrombus throughout the jugular bulb, sigmoid sinus, transverse sinus and torcula, preventing passage of a microcatheter from a retrograde approach. (B) Placement of transcranial 7 Fr sheath directly into the anterior portion of the superior sagittal sinus to allow direct access for thrombectomy and chemical thrombolysis.

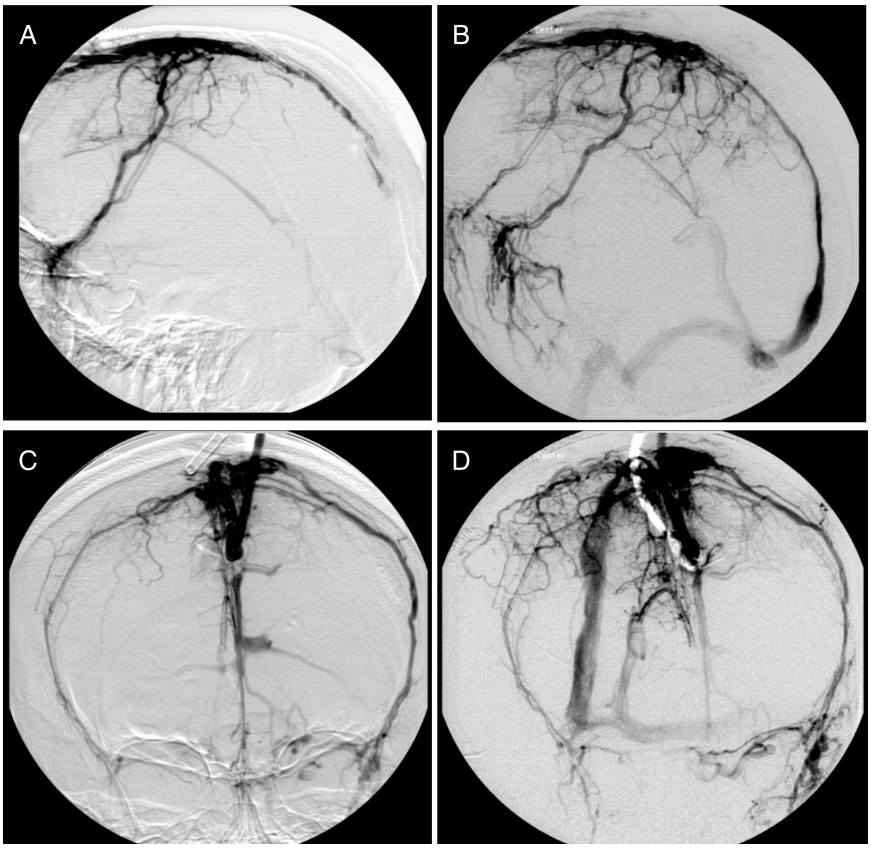

Figure 3 Digital subtraction sinography during injection via the anterior superior sagittal sinus sheath access site. Pre-thrombolysis and thrombectomy images (A, C) and post-thrombectomy and thrombolysis images (B, D) demonstrate restoration of patency in the posterior superior sagittal sinus and torcula; there is persistent occlusion of the right transverse sinus.

venous circulation, but persistent occlusion of the distal right transverse and sigmoid sinuses (figure 3). All indwelling catheters were then removed. The SSS sheath was removed in the operating room the next day without complication. Two days later, arteriography showed a lack of mid-SSS filling and adjacent cerebral veins but excellent collateral venous outflow and normal arteriovenous transit time.

OUTCOME AND FOLLOW-UP

By hospital day 21 the patient had significantly improved (Glasgow Coma Score (GCS) 15), with residual right arm and leg weakness (4+/5 strength). Functional outcome measurements at 3 months yielded a GCS-extended score of 'upper moderate disability', modified Rankin Scale score of 2 ('slight disability') and a Barthel Index of 78/100. Major persistent issues included assistance with showering, dressing and climbing stairs due to mild right-sided hemiparesis.

DISCUSSION

Dural sinus thrombolysis usually requires catheterization of the internal jugular vein(s), retrograde placement of a guidewire into the obstructed sinus and sliding of a microcatheter over the guidewire for infusion of a thrombolytic agent. If the thrombus is so hard that retrograde passage of a guidewire is impossible, alternative access to the sinus must be sought. There are a few cases described of open surgical thrombectomy using a balloon catheter.[6–8] However, we have presented the first case of accessing the SSS via a burr hole for the passage of a flexible thrombectomy device, followed by placement of infusion catheters for prolonged thrombolysis. While the outcome in this case was excellent, it is important to note that this surgical procedure introduces additional risks, including air emboli and increased risk of intracranial hemorrhage.[7]

Antegrade access to the dural sinuses may facilitate endovascular treatment of select cases of severe sinus thrombosis, and should be considered in patients who cannot achieve recanalization using standard retrograde access. With the development of more flexible and efficacious thrombectomy systems, such as those to remove large clots in the systemic venous system,[9] this antegrade approach to the obstructed dural sinuses should be considered.

Learning points

- Some cases of dural sinus thrombosis are not amenable to standard retrograde endovascular therapies due to significant occlusive clot burden.
- Anterior superior sagittal sinus access via burr hole craniotomy is a viable option to provide access for endovascular therapy.
- There is a role for neurosurgical intervention to facilitate endovascular therapy in select cases of dural sinus thrombosis.

Contributors DJL: manuscript design, data acquisition, drafted and revised manuscript, final approval, accountable for all aspects of the work. REL: patient care, manuscript design, data interpretation, revised manuscript, final approval, accountable for all aspects of the work. BCD, PRD, PV: patient care, data interpretation, revised manuscript, final approval, accountable for all aspects of the work. JPM: manuscript design, data interpretation, revised manuscript, final

approval, accountable for all aspects of the work. KS: patient care, manuscript design, data analysis and interpretation, drafted and revised manuscript, final approval, accountable for all aspects of the work.

Competing interests None.

Patient consent Obtained.

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