CASE REPORT

Onyx embolization of an avulsed thalamoperforator following endoscopic colloid cyst and lamina terminalis fenestration

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SUMMARY

A patient presented with headaches and was found to have a colloid cyst in the third ventricle and ventriculomegaly. The patient underwent endoscopic colloid cyst resection and third ventriculostomy without incidence. Prior to emergence, a blown right pupil was acutely noted, and bright red blood emanated from the ventricular drain that was routinely placed in the endoscopy tract at the conclusion of the procedure. CT angiography demonstrated active extravasation from the pre-pontine cistern into the third ventricle and subarachnoid space. Emergency DSA confirmed active extravasation from an avulsed thalamoperforator arising from the proximal right P1 posterior cerebral artery, which was immediately embolized without incident.

BACKGROUND

Endoscopic colloid cyst resection and third ventriculostomy are common neurosurgical procedures. The minimally invasive technique had been developed to mitigate brain trauma and facilitate cyst removal without a craniotomy while providing an alternate CSF drainage pathway.^{1–3} Limited visualization of structures ventral to the lamina terminalis prior to fenestration can result in vascular injury during the procedure. This case report details the benefit of an integrated neurointerventional service for the emergent management of an avulsed thalamoperforating artery.

CASE PRESENTATION

The patient presented with headaches and was found to have a colloid cyst in the third ventricle and ventriculomegaly. The patient was without other neurological findings and underwent endoscopic colloid cyst fenestration and third ventriculostomy without incidence. On completion of the procedure, a ventricular drain (clamped) was placed in the endoscopy tract. After closing, prior to emergence, examination of the patient revealed a dilated right pupil. Mannitol was administered and the ventriculostomy drain was opened, yielding bright red blood. The patient remained intubated and was taken to emergent CT. Non-contrast CT demonstrated enlarged temporal horns with intraventricular and subarachnoid hemorrhage. CT angiography demonstrated active extravasation from the pre-pontine cistern into the third ventricle and subarachnoid space (figure 1).

TREATMENT

The patient was taken emergently to the neuroangiography suite. DSA confirmed active extravasation from an avulsed thalamoperforator arising from the proximal right P1 posterior cerebral artery (PCA). The vessel was catheterized with a Marathon (Covidien, Irvine, California, USA), and Onyx-18 (Covidien) was injected until the avulsed thalamoperforator was casted with Onyx (figure 2). Control angiography demonstrated no active extravasation or opacification of the target vessel.

OUTCOME AND FOLLOW-UP

Post procedure, the patient had a prolonged hospital course, requiring external ventricular drainage due to the intraventricular hemorrhage. The patient was eventually shunted and discharged to a rehabilitation facility.

DISCUSSION

Postoperative hemorrhage is not uncommon following neurosurgical procedures but it is rare to have an identifiable arterial source on CT imaging. Arterial hemorrhage can be devastating and is often not self-limiting without causing an increase in intracranial pressure and severe neurological injury. Prompt evaluation and recognition of arterial hemorrhage is required for life saving therapy.

Visualization of active extravasation of contrast on CT imaging can be difficult. It is rarely seen clinically and has seldom been reported. On non-contrasted imaging, active bleeding is seen as a 'swirl sign' (an area of mixed hyperdensity and hypodensity).⁴ On CT angiography, a stream of contrast was noted in a region devoid of normal vascular anatomy, as in this case. On further examination of CT angiography, the active extravasation of contrast widens over its course as it disseminates into the subarachnoid or intraventricular spaces. The clinical utility of performing a CT angiogram in the setting of postoperative bleeding is unknown but it can have diagnostic benefit, as in the highlighted case. Several reports suggest that the 'spot sign' on CT angiography can predict an increase in intracerebral hemorrhage volume, resulting in deleterious clinical results.^{5 6}

It is not known at which point during surgery the thalamoperforator was injured. It most likely followed fenestration of the lamina terminalis but there was no active hemorrhaging noted intraoperatively. This may be explained by vasospasm of the injured vessel. Over time, relaxation of the vessel

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Figure 1 Non-contrast axial CT (top) demonstrating primarily intraventricular hemorrhage. CT angiogram (bottom) demonstrates a hyperdensity in the posterior third ventricle (arrow) which correlates with active contrast extravasation.

Figure 2 Anteroposterior and lateral DSA (top) demonstrating active extravasation of the contrast which correlates with CT angiogram imaging. A microcatheter injection (top, right) in the perforator artery proves active extravasation from the avulsed perforator. The anteroposterior and lateral post embolization imaging demonstrates complete occlusion of the avulsed artery with no further extravasation.

occurred and arterial bleeding commenced. Another possibility is that the vessel was injured or dissected during surgery and ruptured in a delayed fashion.

Active hemorrhaging occurred for 20 min following external ventricular drain opening, as seen on CT angiography, and for 10 additional minutes on angiography. There are limited options for treatment at this point. Left untreated, iatrogenic injuries can result in persistent hemorrhaging, development of pseudoaneurysms, and delayed rehemorrhaging. In one study, the single most predictive sign of progression to brain death was the 'swirl sign', as high as 74% of patients with spontaneous intracerebral hemorrhage.⁷ Surgical exploration is timely and invasive. Endovascular occlusion is complicated by the small size of the thalamoperforating artery. Given the duration of hemorrhaging (over 30 min), it was unlikely that the bleeding would terminate without active intervention. The majority of the blood was noted to be subarachnoid and intraventricular, and thus a satisfactory recovery of the patient was still possible.

Temporary balloon occlusion of the right P1 PCA was considered and would likely result in cessation of the bleeding; however, long term durability would be questionable at best. In addition, occlusion of the right P1 PCA with minimal heparinization (due to the craniotomy) may cause thromboembolic or hypoperfusion injury. Embolization with microparticles or gelfoam was also considered. Concern for thromboembolic events and their poor visualization limits their utility. The hemorrhaging vessel was too small to support a coil. The two best options for occluding the vessel were deemed to be n-butyl cyanoacrylate glue or Onyx. Navigating a small microcatheter into the avulsed vessel was accomplished quickly, at which point in time 0.23 mL of dimethyl sulfoxide followed by 0.2 mL of Onyx-18 were injected until the majority of the vessel had been casted with Onyx. No further hemorrhaging was encountered.

Learning point

Use of endovascular techniques in an innovative fashion can result in emergent treatment of difficult vascular injuries that are rarely encountered during surgery.

Competing interests None.

Patient consent Obtained.

Ethics approval The study was approved by the institutional review board of the Medical University of South Carolina.

Provenance and peer review Not commissioned; externally peer reviewed.

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