CASE REPORT

Targeted epidural patch with n-butyl cyanoacrylate (n-BCA) through a single catheter access site for treatment of a cerebral spinal fluid leak causing spontaneous intracranial hypotension

Sean Woolen,¹ Joseph J Gemmete,^{1,2} Aditya S Pandey,^{1,2} Neeraj Chaudhary^{1,2}

¹Department of Radiology, University of Michigan Health System, Ann Arbor, Michigan, USA

²Department of Neurosurgery, University of Michigan, Ann Arbor, Michigan, USA

Correspondence to

Dr Joseph J Gemmete, Department of Radiology, Division of Neurointerventional Radiology, University of Michigan, 1500 E Medical Center Dr, UH B1 D328, Ann Arbor, MI 48109-5030, USA; gemmete@med.umich.edu

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SUMMARY

Spontaneous intracranial hypotension (SIH) usually occurs in the setting of a spontaneous cerebral spinal fluid (CSF) leak. We report the first description of a case of SIH caused by a CSF leak which improved after a targeted epidural patch with n-butyl cyanoacrylate (n-BCA) at the right T1–T2 level. An 81-year-old woman presented with an orthostatic headache for 6 days. MRI of the brain with contrast demonstrated low lying cerebellar tonsils, an engorged transverse sinus flow void, bifrontal small subdural fluid collections, and diffuse dural enhancement. CT myelography showed extravasation of intrathecal contrast at the right T1–T2 level. A targeted epidural patch was performed by injection of n-BCA through a catheter at the right T1–T2 level. After treatment, the patient's symptoms immediately improved and she was without a headache at 1-year follow-up.

BACKGROUND

Spontaneous intracranial hypotension (SIH) occurs because of a cerebral spinal fluid (CSF) leak and is typically accompanied by an orthostatic headache.¹ The diagnosis is made with contrast-enhanced MRI of the brain, and the level of the CSF leak is identified by CT myelography.² Once the diagnosis and level of the CSF leak are confirmed, treatment algorithms recommend beginning with conservative therapy. After conservative therapy fails, most studies endorse starting with a targeted epidural

blood patch (EBP).¹ With EBP failure, fibrin sealants have been recommended in some studies.^{3,4} However, certain patients are resistant to any type of treatment and new materials need to be developed to treat a CSF leak. We present a case of SIH caused by a spontaneous CSF leak which resolved after the use of a targeted injection of n-butyl cyanoacrylate (n-BCA; Codman Neurovascular, Raynham, MA, USA) in the epidural space.

CASE PRESENTATION

An 81-year-old woman presented to the emergency room with new-onset severe orthostatic headache of 6 days duration. The headaches became worse at the end of the day after prolonged standing, with some relief in the recumbent position. The patient described the headaches as 'pressure-like', located in the frontal region with spread into the temporal regions bilaterally. The pain was 10/10 on the visual analogue scale. There was no history of prior headaches, trauma, a connective tissue disorder, or chiropractic manipulation. A detailed neurological examination could not elicit a focal deficit. Given the orthostatic headache, a diagnosis of idiopathic hypotension was considered.

INVESTIGATIONS

Initial MRI of the brain with contrast 1 week after presentation to the emergency room revealed low-lying cerebellar tonsils, an engorged transverse sinus flow void, bifrontal small subdural fluid

Figure 1 (A) Sagittal contrast-enhanced T1-weighted MRI shows diffuse pachymeningeal enhancement, posterior fossa crowding, and a sagging brain. (B) Axial FLAIR MRI shows bilateral high signal extra-axial fluid collections.

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Figure 2 Axial CT myelography images show (A) a perineural meningeal cyst with extravasation of intrathecal contrast at the T1–T2 level (B).

Figure 3 (A, B) Axial Dyna-CT images show high attenuation material (n-butyl cyanoacrylate) in the epidural space extending to the area of contrast extravasation.

collections, and diffuse dural enhancement (figure 1A, B). CT myelography of the cervical, thoracic, and lumbar spine showed extravasation of intrathecal contrast at the T1–T2 level, passage of the contrast into the epidural space extending inferiorly to the T8 level, and an associated perineural meningeal cyst at the site of the CSF leak (figure 2A, B).

TREATMENT

The procedure was performed under conscious sedation with the patient prone on the angiographic table. A 19 gauge needle was advanced at the L3–L4 level into the epidural space using the least resistance technique and a small amount of contrast was injected to confirm access into the epidural space. A 0.035 inch glide wire was advanced into the thoracic epidural space and the needle exchanged for a 4 F sheath. A 4 F vertebral catheter was manipulated to the level of C6 and contrast injected. From our experience, we have found it easier to access the epidural space in the cervical and thoracic region by advancing a catheter from the lumbar region, which is the reason why we did not directly puncture the T1–T2 level. A dyna-CT scan of the cervicothoracic spine was performed, confirming the catheter position within the epidural space. A total of 5 mL autologous blood was injected into the lower cervical and upper thoracic epidural space to help with polymerization of the n-BCA. The catheter was then placed in the right aspect of the epidural space at C7. A total of 3 mL of a 3:1 ethiodol:n-BCA mixture was injected through the catheter into the lower cervical and upper thoracic epidural space in the area of the CSF

leak identified on the CT myelogram at T1–T2. A dyna-CT scan of the cervicothoracic spine confirmed glue casting at the site of the CSF leak at T1–T2 (figure 3A, B).

Figure 4 Sagittal T1-weighted MRI 3 months after treatment shows interval resolution of the pachymeningeal enhancement, posterior fossa crowding, and sagging brain.

OUTCOME AND FOLLOW-UP

The headache resolved 1 day after the procedure. At 3-month and 1-year follow-up the patient remained free of a headache. MRI of the brain at 3 months showed interval resolution of the bifrontal subdural fluid collections, diffuse dural enhancement, and low-lying cerebellar tonsils (figure 4).

DISCUSSION

SIH is accompanied by an orthostatic headache, neck stiffness or pain, nausea with or without vomiting, photophobia, as well as hearing changes.^{5–7} A community-based study showed a prevalence of SIH of 1 per 50 000.⁸

MRI of the brain is the preferred imaging modality to investigate for intracranial hypotension. The most common findings seen on MRI of the brain are subdural fluid collections, enhancement of the pachymeninges, engorgement of the venous structures, pituitary hyperemia, and sagging of the brain.⁷ Once the diagnosis of SIH is established, CT myelography is the most accurate study for investigating a CSF leak.

Learning points

- ▶ Orthostatic headache is the most common symptom of spontaneous intracranial hypotension (SIH).
- ▶ A detailed and accurate neurologic examination along with MRI of the brain can help distinguish SIH from other causes of headache.
- ▶ CT myelography can help identify the exact level of the CSF leak.
- ▶ This case shows that targeted injection of n-butyl cyanoacrylate into the epidural space may be helpful in the treatment of patients with SIH.

Once the level of the leak is identified and conservative measures fail, interventional therapy can be performed to stop the leak. Targeted EBP fails to relieve symptoms in approximately 25–33% of cases.⁹ If EBP fails, injection of fibrin glue can stop the CSF leak by forming a physiologic fibrin clot.^{3, 4} However, some patients require multiple EBP procedures and are resistant to fibrin glue management.

Our case with a targeted injection of n-BCA demonstrates a new method for the treatment of a CSF leak. The procedure was effective immediately and the patient was symptom-free at 1-year follow-up.

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