Targeted CT-Guided Epidural Blood Patch for Treatment of Spontaneous Intracranial Hypotension Due to Calcified Intradural Thoracic Disc Herniation

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Summary

Calcified thoracic intradural disc herniations have recently been reported as a cause of spontaneous intracranial hypotension (SIH). We report successful treatment of SIH with a targeted CT-guided epidural blood patch.

A 57-year-old man presented to the emergency department with a two-week history of progressively debilitating headache. CT and MRI of the brain showed findings consistent with intracranial hypotension and MRI of the spine showed findings consistent with CSF leak. Subsequent CT myelogram of the thoracic spine confirmed the presence of CSF leak and calcified disc herniations at the T6-7, T7-8 and T8-9 levels indenting the ventral dura and spinal cord. The calcified disc herniation at T6-7 had an intradural component and was therefore the most likely site of the CSF leak. Under CT fluoroscopic guidance, a 20-gauge Tuohy needle was progressively advanced into the dorsal epidural space at T6-7. After confirmation of needle tip position, approximately 18cc of the patient's own blood was sterilely removed from an arm vein and slowly re-injected into the dorsal epidural space. With satisfactory achievement of clot formation, the procedure was terminated. The patient tolerated the procedure well. The next morning, his symptoms had completely resolved and he was neurologically intact. At five-week follow up, he was symptom-free.

Targeted epidural blood patch at the site of presumed CSF leak can be carried out in a safe and effective manner using CT fluoroscopic

guidance and can be an effective alternative to open surgical management in selected patients.

Introduction

Spontaneous intracranial hypotension (SIH) is an under-diagnosed cause of persistent debilitating headaches. Patients usually present with orthostatic headaches associated with low CSF volume and pressure without a history of instrumentation or penetrating trauma¹. Reported causes of spontaneous CSF leakage in the literature include tears of spinal nerve root sleeves, cervical bone spurs, meningeal diverticula, connective tissue disorders and pre-existing cystic lesions such as arachnoid diverticulum and perineural cysts²⁻⁵. More recently, cases of SIH associated with spinal degenerative lesions, specifically calcified thoracic intradural disc herniations, have been reported⁶⁻⁸.

In most cases, SIH is treated successfully with conservative management including bed rest, high fluid intake and caffeine⁹⁻¹¹. When conservative measures fail to resolve symptoms, blind lumbar epidural blood patches have been shown to be effective at treating the CSF leak^{10,12-15}. While successful in the lumbar region, blind epidural blood patches may not be effective for SIH related to calcified thoracic intradural disc herniations given the anatomic location of the dural defect. We report on a patient with SIH secondary to calcified thoracic intradural disc herniations successfully treated with targeted CT-guided epidural blood patch.

Figure 1 Non-contrast CT images of the head showing bilateral subdural collections with slight effacement of sulci and small caliber of lateral ventricles.

Figure 2 Axial T2, sagittal T1 and coronal T1 post-contrast images of the brain show diffuse smooth pachymeningeal enhancement with small bilateral subdural fluid collections, effacement of the suprasellar cistern and sagging appearance of the midbrain consistent with intracranial hypotension.

Case Report

A 57-year-old man presented to the emergency department with a two-week history of progressively debilitating headache. He described the headache as starting in the base of

his neck and radiating to the top of his head. The headache was significantly worse with standing. There was occasional nausea with vomiting but he denied any significant visual symptoms. There was no history of recent trauma or instrumentation. He had been previously

Figure 3 Sagittal and axial T2 weighted images of the thoracic spine show epidural fluid collection similar in signal characteristics to CSF, suggestive of CSF leak.

treated with ibuprofen by his primary care physician without relief.

His medical history was significant for hypertension, hyperlipidemia, hypothyroidism and seizure disorder. At presentation, his vital signs were stable and his physical examination was

Figure 4 Sagittal and axial post-myelogram CT images showing calcified disc herniations in the thoracic spine indenting the ventral dura and spinal cord. Note the high-density epidural collection dorsally suggesting leak of contrast from the spinal canal correlating to the abnormality seen on prior MRI examination.

Figure 5 Two screen saves from CT-guided epidural blood patch at T6-7 showing opacification of the epidural space, both dorsal and ventral, with subsequent clot formation.

unremarkable; specifically he was neurologically intact. Laboratory tests obtained, including CBC, chem 7, LFTs and coagulation studies, were within normal limits. CT of the head without intravenous contrast was obtained and showed extra-axial fluid with mild sulcal effacement and small caliber of the ventricular system (Figure 1). Due to concern for subdural hematoma, the patient was admitted and transferred to a tertiary care center for further work-up.

MRI examination of the brain with intravenous contrast was performed and showed findings consistent with intracranial hypotension including diffuse smooth pachymeningeal enhancement, small bilateral subdural fluid collections, effacement of the suprasellar cistern and sagging appearance of the midbrain (Figure 2). The patient subsequently underwent MRI imaging of the entire spine which showed a circumferential epidural CSF intensity collection spanning the thoracic region suggesting CSF leak (Figure 3). To further interrogate the site of CSF leak, the patient underwent CT myelography with imaging of the thoracic spine in both the prone and supine positions. This confirmed the presence of CSF leak with high-density contrast material within the thoracic epidural space. Calcified disc herniations were noted at the T6-7, T7-8 and T8-9 levels indenting the ventral dura and spinal cord (Figure 4). After thorough interrogation of the CT myelogram, it was felt that the calcified disc herniation at the T6-7 level had an intradural compo-

nent and was therefore the most likely site of CSF leak.

CT-guided epidural blood patch was performed by the lead author (VA). Briefly, the patient was placed prone on the CT table and scout CT images of the mid-lower thoracic spine obtained at 3 mm slice thickness. A suitable trajectory to the dorsal epidural space at the T6-7 level was identified. The overlying skin was marked and the area was prepped and draped in the usual sterile fashion. Local anesthesia was obtained with 1% buffered lidocaine solution. Using intermittent CT fluoroscopy for guidance, a 20-gauge Tuohy needle was introduced into the soft tissues of the back and progressively advanced until the tip resided in the dorsal epidural space. Confirmation of needle tip position was made with CT fluoroscopy, loss of pressure resistance, and a small hand injection of approximately 0.3 cc of 180 mg/cc Omnipaque contrast. No intravascular or intrathecal contrast was identified. Safe needle tip position having been confirmed, approximately 18 cc of the patient's own blood was sterilely removed from an arm vein by the radiology nurse and then slowly re-injected into the dorsal epidural space. Intermittent fluoroscopic monitoring demonstrated expected flow within the epidural space, both dorsal and ventral, without intravascular or intrathecal opacification (Figure 5). With satisfactory achievement of clot formation, the procedure was terminated. The needle was removed and hemostasis obtained.

Results

The patient tolerated the procedure and there were no cardiovascular or neurologic complications after approximately three hours of monitoring. Immediate post-procedure CT through the region of interest showed contrast material within the epidural space, both ventrally and dorsally with small locules of gas from T6-7 through the T9-10 levels. There was no suggestion of spinal canal or spinal cord compromise. A few hours after the procedure, the patient noted a significant improvement in his headache and was able to ambulate without difficulty. The next morning, his symptoms had completely resolved and he was neurologically intact. He was discharged with instructions to refrain from strenuous activity and heavy lifting for two months at which time he could resume prior activities with gradual increments. At five-week follow-up, he was symptom-free.

Discussion

Despite increasing recognition, spontaneous intracranial hypotension (SIH) remains an under-diagnosed cause of daily persistent headaches⁹. The estimated prevalence in the general population is 1:50,000 and 1:20,000 among emergency department presentations with headache¹⁰. The typical patient is middle-aged and presents with orthostatic headaches associated with low CSF volume and pressure in the absence of prior instrumentation or penetrating trauma¹. Patients may also complain of nausea, vomiting, photophobia and rarely a decreased level of consciousness.

CT of the head is relatively insensitive in the diagnosis. Subdural fluid collections may be present and have variable density ranging from hygromas to hematomas. The suprasellar cistern may appear to be obliterated and the atria of the lateral ventricles may appear medialized. Magnetic resonance imaging (MRI) is more sensitive. Findings include diffuse smooth meningeal enhancement, thickened hyperintense dura with or without bilateral subdural collections, crowding or effacement of the suprasellar cistern, sagging of the mid-brain and caudal displacement of the cerebellar tonsils¹⁶. There can be a variety of causes of spontaneous CSF leakage, most commonly tears of spinal nerve root sleeves. In addition, cervical bone spurs, menin-

geal diverticula, connective tissue disorders and pre-existing cystic lesions such as arachnoid diverticulum and perineural cysts have all been reported as underlying pathogenic factors²⁻⁵.

Cases of SIH associated with spinal degenerative lesions have been identified, the majority of these associated with cervical bone spurs^{2,17,18}. More recently, SIH due to calcified thoracic intradural disc herniations have been reported^{6-8,19,20}. Conservative management with bed rest, high fluid intake and caffeine remains the first line treatment of patients with SIH and is sufficient in most cases⁹⁻¹¹. Medical therapy with theophylline, glucocorticosteroids or mineralocorticoids can be used in conjunction¹². When conservative measures fail to resolve symptoms, blind lumbar epidural blood patches can be carried out safely^{10,12-15}. Unfortunately, lumbar epidural blood patches may only provide temporary symptomatic improvement in two thirds of cases⁹. With specific regard to SIH caused by calcified thoracic intradural disc herniations, only one case in the literature was successfully treated with blind lumbar epidural blood patch²⁰ and one case successfully treated with targeted epidural blood patch⁶. In all but one of the remaining cases, open surgical procedures were performed. In the exception, the patient declined surgery. Although no significant data regarding the efficacy rate of targeted blood patches exists, various case reports in the past demonstrate a more than 50% success rate for targeted blood patches at the site of leak^{5,9,10,11,18}.

In the thoracic spine, targeted epidural blood patch can be carried out effectively in a safe manner using CT fluoroscopy and should be considered prior to surgical treatment especially in those cases where blind lumbar epidural blood patches have proven unsuccessful.

Conclusion

Calcified thoracic intradural disc herniations are an often underdiagnosed cause of spontaneous intracranial hypotension. After failure of first line conservative management, blind lumbar blood patches are often performed but may not be effective. Targeted epidural blood patch at the site of presumed CSF leak can be carried out in a safe and effective manner using CT fluoroscopic guidance and can be an effective alternative to open surgical management in selected patients.

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