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Spontaneous Intracranial Hypotension: Tracking a Type 2 Cervical CSF Leak

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ABSTRACT

Spontaneous intracranial hypotension (SIH) is most commonly related to spontaneous spinal cerebrospinal fluid (CSF) loss and typically presents with orthostatic headache. We report the case of a 48-year-old woman with a three-month history of orthostatic headaches associated with vomiting and dizziness who subsequently developed binocular diplopia due to a right abducens nerve palsy. Cerebral MRI demonstrated characteristic features of SIH, including pachymeningeal enhancement, pituitary engorgement, and deep venous distension. Whole-spine MRI revealed a predominantly ventral spinal longitudinal extradural CSF collection extending from C6 to L3. Post-contrast coronal 3D STIR-SPACE imaging further demonstrated a diverticular abnormality of the right C7 nerve root sleeve with an associated fluid tract consistent with CSF leakage, supporting the diagnosis of a type 2 lateral spinal CSF leak. No invasive myelographic examination was performed, and the patient was referred for neurosurgical evaluation. This case highlights delayed abducens nerve palsy as an uncommon manifestation of SIH and illustrates the potential role of tailored high-resolution spinal MRI in noninvasive leak localization when the source is directly visualized.

KEYWORDS

Spontaneous intracranial hypotension, spinal cerebrospinal fluid leak, abducens nerve palsy, meningeal diverticulum, T2-SPACE MRI

MAIN ARTICLE

INTRODUCTION

Spontaneous intracranial hypotension (SIH) is most often caused by spontaneous spinal cerebrospinal fluid loss and typically presents with orthostatic headache [1]. Cranial nerve palsies are uncommon, with the abducens nerve being particularly vulnerable to traction related to reduced CSF volume. Spinal leaks may arise from dural tears, lateral nerve-root sleeve abnormalities, or CSF-venous fistulas [2]. We report a case of SIH with delayed right abducens nerve palsy attributed to a type 2 leak at the right C7 nerve root sleeve, identified on high-resolution spinal MRI.

CASE PRESENTATION

A 48-year-old woman with asthma presented with a three-month history of orthostatic headaches associated with vomiting and dizziness. Two weeks before evaluation, she developed binocular diplopia, and clinical examination revealed a right abducens nerve palsy. There was no history of trauma, lumbar puncture, spinal surgery, or other invasive spinal procedure.

Cerebral imaging demonstrated pituitary engorgement with a convex superior margin and distension of the deep cerebral venous system, particularly the straight sinus and great cerebral vein. Delayed post-contrast fat-saturated T1-weighted images acquired during orbital MRI showed diffuse pachymeningeal enhancement on the available cerebral sections (Figures 1A, 1B). No abnormality involving the right abducens nerve, orbital structures, brain parenchyma, posterior fossa, or intracranial vessels was identified. These findings were consistent with spontaneous intracranial hypotension.

Whole-spine MRI demonstrated a circumferential spinal longitudinal extradural CSF collection (SLEC), predominantly ventral and extending from C6 to L3, on sagittal T2-weighted imaging (Figure 2).

Post-contrast coronal 3D STIR-SPACE imaging showed a diverticular outpouching at the foraminal segment of the right C7 nerve root sleeve, with a fluid-signal tract consistent with CSF leakage extending along the ipsilateral brachial plexus toward the lower trunk (Figure 3).

Additional multilevel meningeal diverticula were present, most prominently at C2-C3. No spinal cord signal abnormality was observed. These findings were consistent with a type 2 lateral spinal CSF leak arising from the right C7 nerve root sleeve.

The patient was subsequently referred for neurosurgical evaluation.

DISCUSSION

Spontaneous intracranial hypotension (SIH) is a clinical and radiological syndrome of reduced cerebrospinal fluid (CSF) volume, most often resulting from spontaneous spinal CSF loss. A low lumbar puncture opening pressure is not required for diagnosis, as normal values are reported in approximately one-third of patients [1]. Spontaneous spinal CSF leaks are traditionally classified as type 1 dural tears, type 2 lateral nerve-root sleeve leaks historically associated with meningeal diverticula, and type 3 CSF-venous fistulas [2]. More recent surgical evidence suggests that many type 2 leaks result from a lateral dural tear with arachnoid outpouching rather than rupture of a true meningeal diverticulum [3]. Orthostatic headache is the predominant manifestation, occurring in approximately 92% of patients, and may be accompanied by nausea or vomiting, dizziness, neck pain or stiffness, tinnitus, or hearing disturbances [1]. Abducens nerve palsy is an uncommon manifestation and is thought to result from traction on the nerve caused by downward displacement of intracranial structures [4,7]. In our patient, the initial presentation was typical of SIH, whereas the delayed right abducens nerve palsy represented a less common manifestation.

Neuroimaging has complementary roles in SIH. Contrast-enhanced brain MRI and whole-spine MRI are recommended as first-line examinations [5,8]. Typical brain MRI findings include diffuse pachymeningeal enhancement, venous sinus distension, pituitary engorgement, brain sagging, and subdural collections [1,5,8]. In our patient, brain MRI showed characteristic intracranial features of SIH. On spinal MRI, sagittal T2-weighted imaging demonstrated an extensive SLEC, while post-contrast 3D STIR-SPACE imaging depicted the right C7 nerve root sleeve diverticular abnormality and an associated fluid-signal tract consistent with CSF leakage.

The presence and distribution of a spinal longitudinal extradural CSF collection (SLEC) can provide useful clues to the underlying leak type and guide subsequent imaging. SLEC-positive examinations are commonly associated with dural tears or lateral nerve-root sleeve leaks,

whereas SLEC-negative studies raise greater suspicion for a CSF-venous fistula [9]. High-resolution heavily T2-weighted three-dimensional spinal sequences improve visualization of extradural CSF and meningeal diverticula and may help identify a suspicious level before invasive myelography [10]. In our patient, the extensive SLEC and focal right C7 nerve-root sleeve abnormality were concordant, supporting this level as the likely source of leakage.

When spinal MRI does not adequately localize a CSF leak, dynamic CT myelography or digital subtraction myelography may be required [5,8]. T2-SPACE imaging has been described as a noninvasive screening technique for detecting extrathecal CSF, although further myelographic evaluation may still be necessary to establish the precise leak site [6,10]. In our patient, the extensive SLEC was visible on sagittal T2-weighted imaging, while post-contrast 3D STIR-SPACE imaging directly depicted the right C7 nerve root sleeve abnormality and associated CSF leakage. Although no invasive myelographic examination was performed, these findings were sufficiently conspicuous to identify the likely source of the leak. The nontraumatic C7 location is also noteworthy, as a recent surgical series of spontaneous type 2 leaks reported lesions between T7 and L2 [3]. This case illustrates the potential value of tailored high-resolution three-dimensional MRI when the source of the leak is directly visualized, while myelography remains important when MRI findings are inconclusive.

Persistent or recurrent symptoms may prompt further leak localization and consideration of targeted patching or surgical repair [5].

CONCLUSIONS

Delayed abducens nerve palsy may develop during the course of spontaneous intracranial hypotension and should prompt evaluation for an underlying spinal CSF leak. In this patient, spinal MRI demonstrated an extensive SLEC and localized the likely source to a nontraumatic type 2 leak at the right C7 nerve root sleeve. This case highlights the value of tailored high-resolution spinal MRI for noninvasive leak localization when the abnormality is directly visualized.

FIGURES :

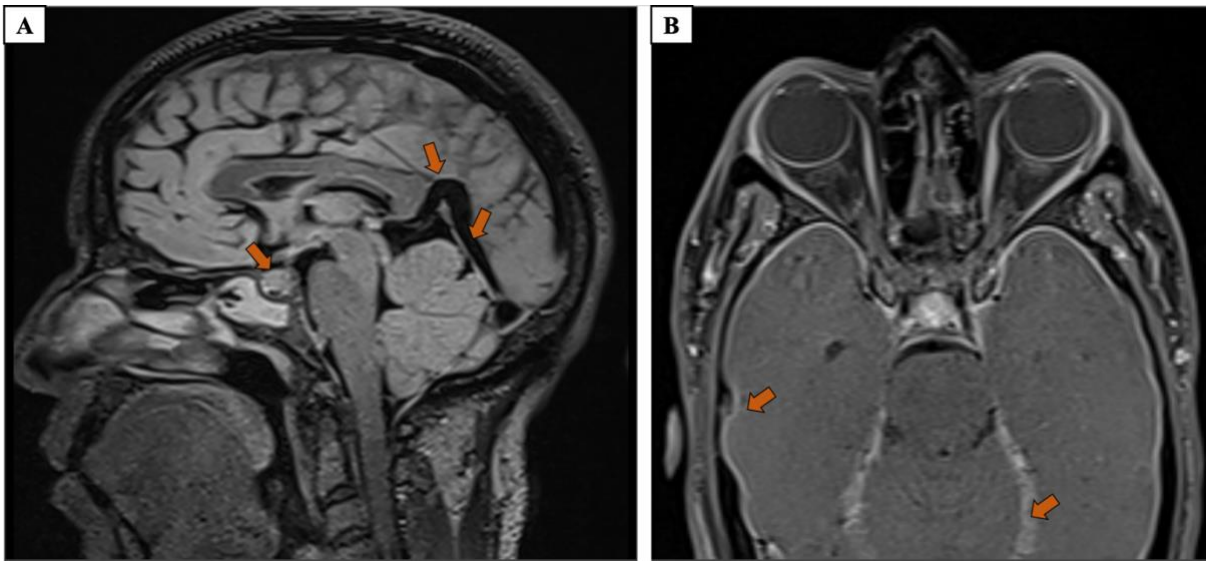


Figure 1:
A: Sagittal FLAIR image showing engorgement of the straight sinus and great cerebral vein, associated with pituitary engorgement and a convex superior pituitary margin.
B: Delayed post-contrast fat-saturated T1-weighted image obtained during orbital MRI demonstrating pachymeningeal enhancement on the included cerebral sections.

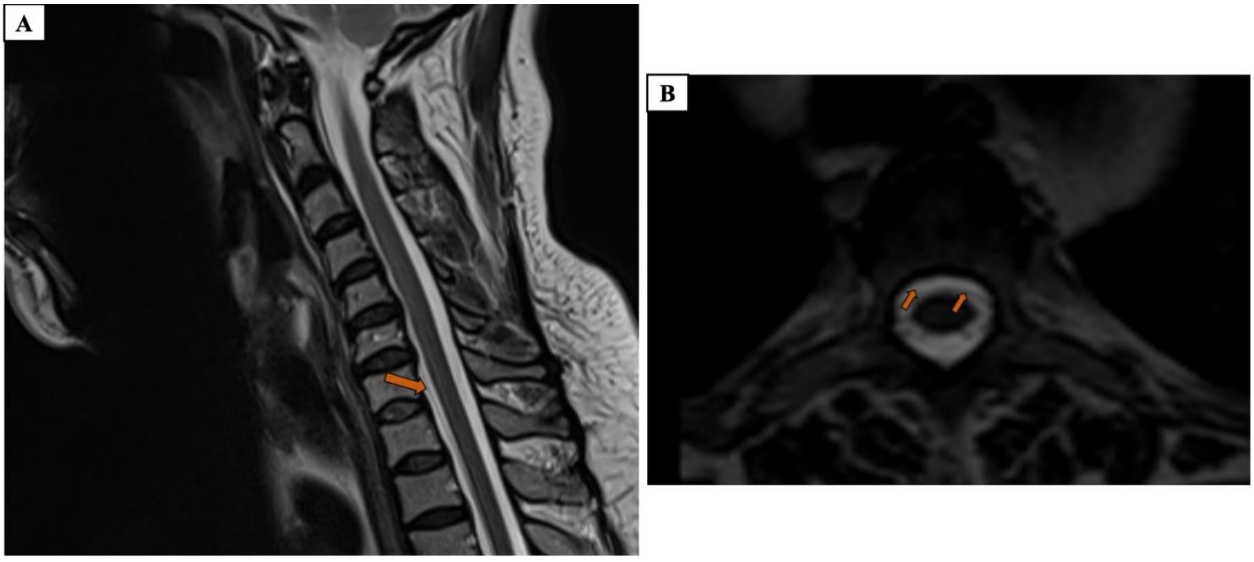


Figure 2:
A: Sagittal T2-weighted spinal MRI demonstrating a circumferential spinal longitudinal extradural cerebrospinal fluid collection, predominantly ventral, extending from C6 to L3. Arrowheads indicate the extradural fluid collection.
B: Note the extradural cerebrospinal fluid collection on axial T2-weighted image.

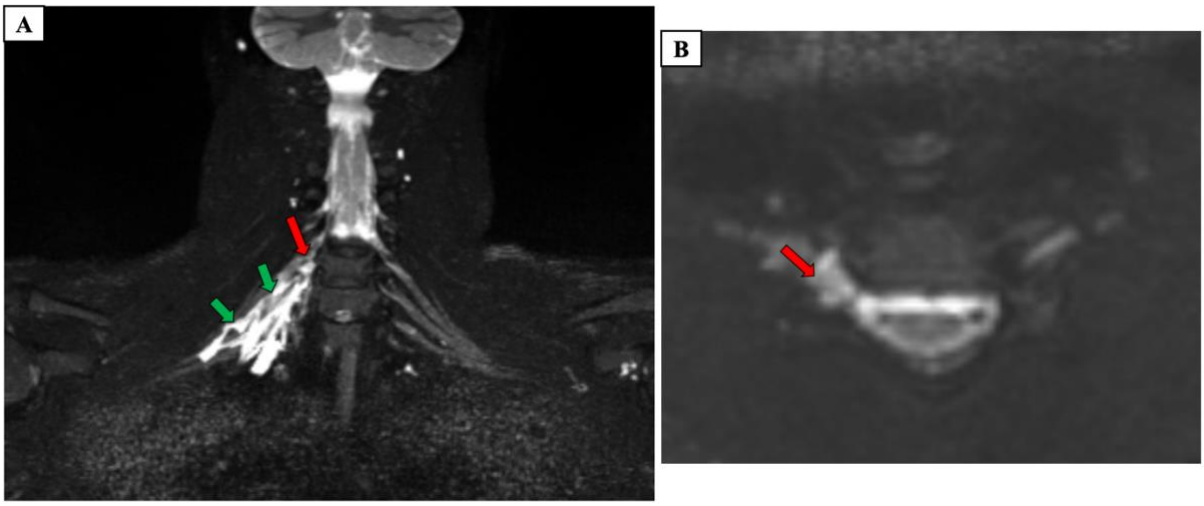


Figure 3:
A: Post-contrast coronal 3D STIR-SPACE image demonstrating a diverticular outpouching at the foraminal segment of the right C7 nerve root sleeve (red arrow), with an associated fluid tract consistent with cerebrospinal fluid leakage extending along the ipsilateral brachial plexus toward the lower trunk (green arrows).
B: Note the diverticular outpouching of the right C7 nerve root sleeve (red arrow)

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