Journal of Pain Clinicians of India (JPCI)

Official Publication of the Indian Society of Pain Clinicians
Volume 1 · Issue 1 · 2026 · ISSN: Applied For

CASE SERIES

Beyond the Lumbar: Targeted Cervical Epidural Blood Patch for Refractory Spontaneous Intracranial Hypotension and Associated Complications

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Abstract

Spontaneous intracranial hypotension (SIH) from spinal cerebrospinal fluid (CSF) leaks is a challenging pain condition, often misdiagnosed and refractory to standard lumbar epidural blood patches (EBP). We present two cases demonstrating the efficacy of targeted cervical EBP in managing complex SIH with significant associated morbidity. A 36-year-old male with cervicothoracic CSF leaks developed bilateral subdural hematomas despite conservative management. Fluoroscopy-guided targeted cervical EBP at C7–T1 using slow incremental autologous blood injection (~1 mL/min) resulted in sustained symptomatic resolution after two injections, highlighting its efficacy even with an active leak. A 31-year-old female with SIH and a systemic connective tissue disorder experienced immediate and sustained relief following a single targeted cervical EBP at C7–T1, underscoring the importance of addressing underlying predispositions. These two cases illustrate that targeted, image-guided cervical EBP was a safe and effective intervention for refractory SIH in these two patients, including presentations complicated by subdural hematoma or linked to connective tissue disorder.

Keywords

Spontaneous intracranial hypotension, epidural blood patch, cerebrospinal fluid leak, orthostatic headache

Introduction

Spontaneous intracranial hypotension (SIH) is a debilitating neurological syndrome driven by spinal CSF hypovolemia, most commonly originating from occult structural dural defects. The hallmark clinical feature is an orthostatic headache, triggered by caudal sagging of intracranial contents and compensatory venous engorgement. While brain and spine magnetic resonance imaging (MRI) typically establish the initial diagnosis, precise localization of high-flow or upper spinal leaks frequently requires advanced modalities such as computed tomography (CT) myelography [1].

When conservative measures fail, autologous epidural blood patching (EBP) serves as the primary interventional standard, relying on local mass effect and subsequent clot formation to seal the

dural breach [2]. Because a significant proportion of spontaneous leaks cluster within the cervicothoracic junction, traditional blind lumbar patches often yield temporary or inadequate results due to insufficient rostral blood migration. This case series details the clinical and technical framework of targeted cervical EBP in treating refractory, high-complexity SIH.

Case Reports

Case 1 – Refractory SIH Complicated by Subdural Hematoma

A 36-year-old male painter presented with a two-month history of acute-onset orthostatic occipital headache and neck pain refractory to conservative management, including strict bed rest and aggressive hydration. Initial brain CT was unremarkable; however, follow-up brain MRI revealed bilateral subdural fluid collections, cerebellar tonsillar descent, and prominent dural venous sinuses. Subsequent spinal imaging confirmed a cervicothoracic CSF leak localized at the C2–3 level, accompanied by extensive dorsal epidural fluid collections spanning from C3 to T1 (Figure 1).

Despite continued conservative efforts, his clinical status deteriorated, necessitating readmission following the development of bilateral subdural hematomas. Given the failure of conservative therapy and rapid neurological threat, an interventional approach was pursued.

Procedural Execution & Technical Parameters

- **Positioning and Safety Monitoring:** The patient was placed prone with slight cervical flexion to optimize the interlaminar space. Standard continuous monitoring included electrocardiography, pulse oximetry, non-invasive blood pressure tracking, and ongoing verbal engagement to monitor for early indicators of root irritation or neural compromise.
- **Access and Active Egress Management:** Under continuous live fluoroscopy, the C7–T1 interlaminar space was accessed using a Tuohy needle via a loss-of-resistance to sterile saline technique (Figure 2). Upon entry, active CSF efflux was observed exiting freely through the needle hub, confirming direct communication with the subarachnoid/epidural interface. Operators proceeded deliberately, permitting transient, controlled decompression prior to patch deployment to avoid acute intracranial pressure shifts or rapid volume depletion.
- **Contrast Validation:** A preliminary injection of non-ionic contrast medium confirmed accurate dorsal epidural placement and demonstrated a smooth, longitudinal rostral spread tracking upward toward the upper cervicothoracic junction.
- **Injection Dynamics:** An initial incremental volume of 7 mL of autologous blood was injected manually at a controlled rate of approximately 1 mL/min. The patient reported a transient sensation of posterior neck pressure without acute paresthesia or motor deficit. This first session provided partial symptom relief.
- **Repeat Intervention:** A second targeted EBP was performed at the same C7–T1 interlaminar space one week later using an 8 mL autologous volume under identical monitoring protocols.
- **Outcome and Surveillance:** No acute procedural complications occurred. The patient was closely monitored post-procedurally for signs of rebound intracranial hypertension (RIH)—such as non-orthostatic, frontal-predominant headaches—none of which developed. The second targeted session achieved near-complete resolution of orthostatic symptoms, sustained at the one-month follow-up.

Case 2 – Connective Tissue Disorder-Associated SIH

A 31-year-old female with a background history of hypothyroidism presented with subacute orthostatic headaches, neck pain, back pain, and intractable vomiting. Initial physical examination revealed mild reactive cervical lymphadenopathy with an otherwise unremarkable neurological evaluation. Brain MRI demonstrated diffuse pachymeningeal enhancement characteristic of intracranial hypotension, while spinal imaging revealed extensive epidural fluid collections extending posteriorly from T3 to T10 and anteriorly from C2 to T2 (Figures 3 & 4).

Given the refractory symptoms and extensive imaging findings, a fluoroscopy-guided cervical EBP was scheduled.

- **Technical Details:** With the patient positioned prone under standard hemodynamic and neurological monitoring, the C7–T1 interlaminar space was successfully engaged. A small non-ionic contrast test-dose confirmed optimal epidural distribution tracking into the lower cervical and upper thoracic planes. Autologous blood (8 mL) was injected incrementally at ~1 mL/min. The patient reported mild, self-limiting cervical fullness, with no adverse events.
- **Clinical Course:** Immediate and sustained relief of orthostatic symptoms was observed. Subsequent immunological workup demonstrated a positive antinuclear antibody (ANA) titer, establishing an underlying connective tissue disorder (CTD) and prompting formal co-management with rheumatology.

Discussion

Spontaneous intracranial hypotension (SIH) remains a diagnostic hurdle characterized by variable clinical presentations that frequently mimic primary headache disorders or intracranial pathology. While orthostatic headache serves as the diagnostic anchor, atypical presentations marked by acute subdural hematoma formation (Case 1) or underlying systemic fragility (Case 2) mandate a low threshold for advanced neuroimaging. Subdural hematomas, as observed in our first patient, arise from the caudal sagging of intracranial contents that exerts downward traction on fragile bridging veins, underscoring the critical need for prompt intervention before irreversible mass effect occurs — a management challenge recently reinforced in contemporary case literature highlighting the efficacy of targeted cervical interventions for such hemorrhagic complications [3].

Current paradigms emphasize that conservative measures should not be prolonged indefinitely once imaging confirms active spinal CSF leaks, particularly when mass-effect complications like subdural hematomas emerge. Although traditional blind lumbar patches remain popular due to technical ease, their efficacy drops significantly when leaks are situated in the mid-to-upper cervical spine. Previous reports and reviews have highlighted the limitations of untargeted lumbar patches, suggesting they may offer only temporary symptomatic relief rather than providing a permanent seal [4]. Studies have shown that targeted EBP, guided by imaging modalities like CT myelography, can lead to superior long-term outcomes by delivering autologous blood directly to the compartment of pathology [5,6,7].

The cervicothoracic junction (C7–T1), utilized in both presented cases, represents a high-frequency anatomical zone for cervicothoracic CSF leaks and serves as an optimal access point for targeted interventions, reflecting a growing consensus on the necessity of direct local therapy [5].

Rationale for C7–T1 Access in High Leaks

Targeting the immediate site of a high cervical leak (e.g., C2–3 in Case 1) via direct local puncture carries substantial technical risks, including close proximity to the spinal cord, a narrow

interlaminar window, and potential neural trauma. Selecting the cervicothoracic junction (C7–T1) provides a safer, wider anatomical corridor while leveraging negative intraspinal pressure gradients and prone patient positioning to drive injected autologous blood rostrally toward higher pathology. As demonstrated in these cases, image-guided verification of rostral contrast spread prior to blood delivery ensures appropriate target coverage without requiring hazardous upper cervical needle placements. Furthermore, identifying concurrent systemic etiologies, such as connective tissue disorders, is essential for long-term management, as underlying dural structural weakness significantly increases failure and recurrence rates.

Study Limitations

These observations must be interpreted within the context of inherent design limitations:

- **Sample Size:** Findings are derived from a two-case series and cannot be generalized across the diverse spectrum of all SIH presentations.
- **Lack of Control:** The absence of a randomized comparator group limits definitive comparative efficacy claims against lumbar-only patching or surgical ligation.
- **Follow-up Duration:** Clinical tracking was restricted to a one-month window, precluding long-term evaluations of delayed leak recurrence or late-onset complications.
- **Scope of Claims:** Procedural success reflects individual clinical trajectories within these specific anatomical environments rather than establishing universal safety guarantees.

Conclusion

This two-case series highlights the technical feasibility, procedural safety, and clinical utility of targeted cervicothoracic epidural blood patching for complex, refractory SIH. Image-guided access at the C7–T1 level offers a reliable pathway to achieve rostral tamponade for high leaks while minimizing the hazards associated with direct upper cervical puncture. Timely intervention remains critical to prevent severe downstream morbidity such as subdural hematoma accumulation.

Figures



Figure 1. CT myelogram showing contrast pooling in the extradural space from the C3 to T1 levels, demonstrating the extent of the cervicothoracic CSF leak.



Figure 2. Fluoroscopic view showing targeted C7–T1 Tuohy needle placement with verification of rostral contrast spread.



Figure 3. Sagittal T2-weighted MRI of the thoracic spine showing a crescentic, broad-based epidural collection involving the posterior dural sac from the T3 to T10 levels.



Figure 4. Sagittal T2-weighted MRI of the cervicothoracic spine revealing extensive epidural collections located anteriorly from the C2 to T2 levels.

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Declarations

Ethics Approval

As these were case reports, a formal ethics committee approval was not required.

Consent for Publication

Written informed consent for publication was obtained for both cases described.

Conflict of Interest

The authors declare no conflicts of interest relevant to this work.

Funding

Funding: No funding was received for this work.

Author Contributions

Dr. Bhavika Singla & Dr. Nishad PK: Conceptualization, Methodology, Patient Management/Investigation, Writing – Original Draft; Investigation (Procedure Assistance/Data Collection), Validation, Writing – Review & Editing.

Dr. Najwa PT: Resources (Patient acquisition/Clinical oversight), Formal Analysis, Data Curation, Visualization.

Dr. Remya RP, Dr. Preetham V & Dr. Sajin CS: Writing – Review & Editing.