



## Case Report

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# Intracranial Hypotension Induced by Cervical Chiropraxis

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Chiropractic care, known for its non-invasive and hands-on approach to healthcare, can occasionally lead to adverse reactions. This case report details an unusual occurrence of intracranial hypotension (IH) in a 30-year-old female who received chiropractic care for neck pain. The patient experienced a throbbing positional headache five days after mobilization and adjustment of the cervical spine. Upon admission, lumbar puncture performed in the lateral position revealed an opening pressure of 55 mm H<sub>2</sub>O. Magnetic resonance imaging showed subdural fluid collection and diffuse pachymeningeal enhancement in the cerebral hemispheres. Radioisotope cisternography revealed dural leakage at the upper cervical level. Following unsuccessful supportive measures, the patient underwent treatment with an epidural blood patch. After the treatment, her postural headaches completely subsided without recurrence. This report underscores that IH syndrome is a rare yet clinically significant complication that may be associated with manipulation of the upper spine.

**Keywords:** Cerebrospinal fluid leakage, Chiropractic, Headache; Intracranial hypotension, Spine manipulation

## Introduction

While generally considered a simple and safe procedure, chiropractic manipulation can result in various adverse outcomes. Transient reactions, such as neck pain or stiffness, headache, dizziness, nausea, fatigue, and muscle soreness, are common [1]. Although considered rare, serious complications such as vertebral fractures, arterial dissections, spinal hemorrhages, retinal detachments, neural damage, and intracranial hypotension (IH) have been reported [2].

Cerebrospinal fluid (CSF) hypovolemia is mostly caused by spinal procedures, cranial and spinal surgeries, myelography, severe dehydration, head and neck trauma, and spontaneous dural tears [3]. Typical features include intrathecal hypotension, posture-related headaches, and meningeal enhancement on cranial magnetic resonance imaging (MRI). Nevertheless, this syndrome still remains an under-diagnosed etiology of new-onset headaches. Recent studies suggest a potential link between IH and manual therapy or procedures for musculoskeletal pain in the neck and back [2,4].

This illustrative case serves as a noteworthy addition, establishing a connection between iatrogenic IH and chiropractic manipulation of the cervical spine. The uniqueness of this report lies in its incorporation of robust imaging findings at the initial presentation and at follow-up after symptom resolution.

## Case report

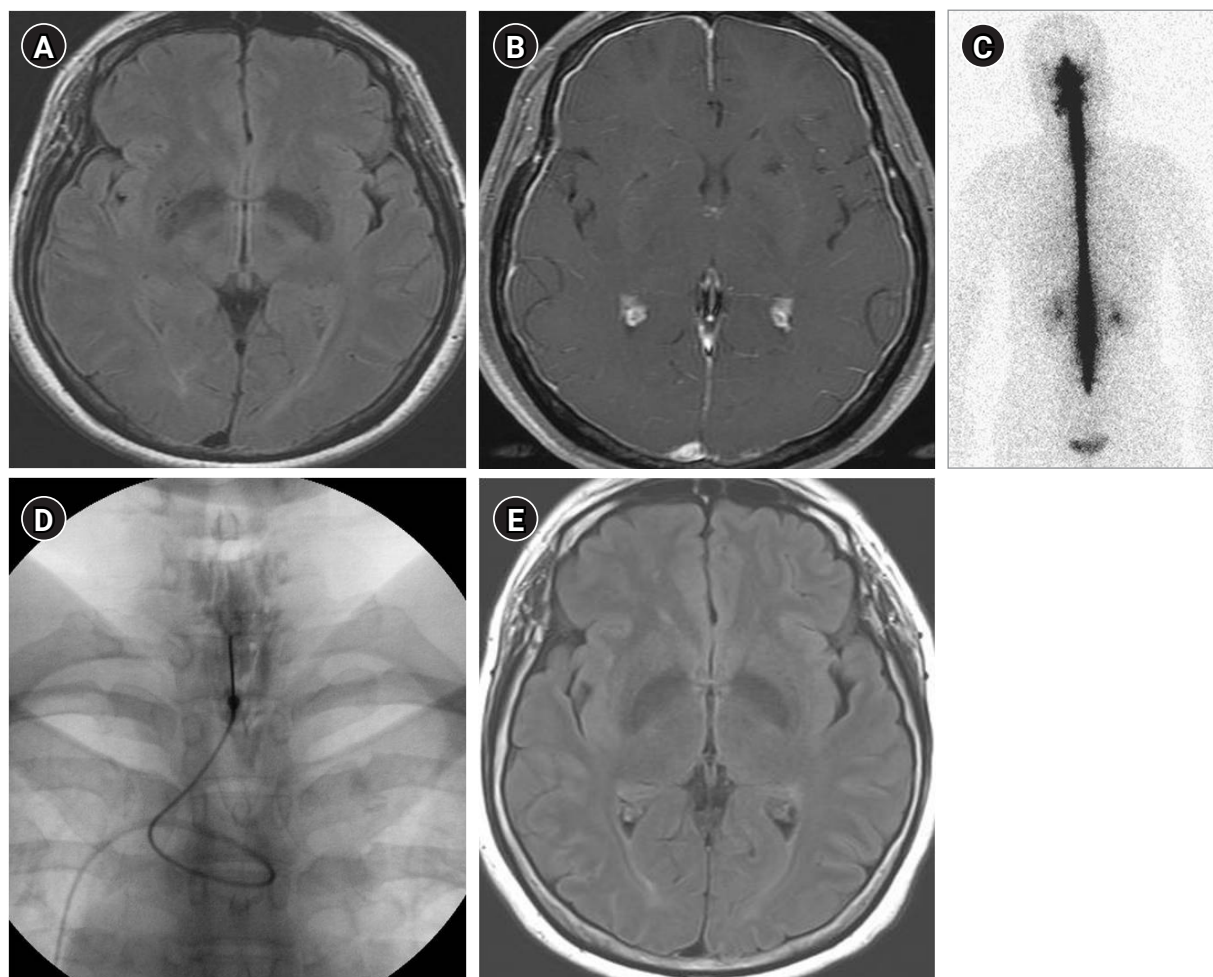
A 30-year-old female presented to the emergency department with a sudden, severe throbbing headache of new onset. She described the pain as a pulling

sensation in the occiput, exacerbated by standing and alleviated by lying down. The patient had no history of spinal tap or head and neck trauma but sought a qualified chiropractor for relief from neck and shoulder aches. Five sessions of usual care were administered twice a week over a two-month period. During cervical therapy, a manual adjustment was applied with directed force to the occipital and posterior nuchal areas, as well as the bilateral shoulders. In each session, the provider grasped the head and applied axial tension while rotating and extending the neck. Five days after the most recent mobilization, the patient experienced persistent pain in her occipital and parietal areas.

Upon admission, the patient's vital signs were stable. Her medical and family history revealed no hereditary connective tissue diseases, and examination of motor, sensory, and crani-

al nerve functions showed no abnormalities. Laboratory values for antinuclear antibody, anticardiolipin antibody, rheumatoid factor, anti-Ro antibody, anti-Sm antibody, anti-RNP antibody, lupus anticoagulant, and anti-Sc170 antibody were all within normal ranges. Cervical spine series revealed no evidence of degenerative changes. Cranial MRI demonstrated bilateral subdural effusion and symmetric contrast enhancement of the dura mater (Fig. 1A, 1B). Radionuclide cisternography identified extradural isotope accumulation at the upper cervical spine, indicating the causative lesion (Fig. 1C). Lumbar CSF opening pressure measured at 55 mm H<sub>2</sub>O in the side-lying position. CSF analysis revealed an increase in total protein (60 mg/dL) with no abnormalities in cell count and glucose concentration.

The patient was diagnosed with IH and initially managed



**Fig. 1.** (A, B) Magnetic resonance imaging (MRI) shows slit-like ventricles with subdural fluid collection and pachymeningeal enhancement in the cerebral convexities. (C) Cisternography at the 6-hour image reveals leakage of radiotracer into the paraspinal soft tissue at the upper cervical level. (D) Fluoroscopic image depicts the application of an epidural blood patch close to the sites of cerebrospinal fluid leak. (E) Follow-up brain MRI demonstrates resolution of prior subdural effusion in both hemispheres.

with rest, intravenous hydration, and analgesics. However, these supportive measures did not alleviate the orthostatic headaches. Eleven days post-admission, an epidural blood patch (EPB) procedure was performed using 17 mL of autologous blood to seal the dural fistulas in the cervical spine (Fig. 1D). This intervention resulted in pain reduction within the following four days. Three weeks post-EPB, the patient was completely headache-free and continued follow-up without further treatments. Five months later, brain MRI showed the complete disappearance of subdural fluid collections (Fig. 1E).

## Discussion

This case did not recount any clinical manifestations other than an acute headache lasting for several days. Headaches resulting from IH can vary from minimal to debilitating, with symptoms that may include altered mental status [5]. Therefore, obtaining a detailed patient history is crucial for accurately diagnosing an IH syndrome in its early stages.

The pathogenesis of IH is not fully established, but the implicated causative factors include spinal CSF leaks. These leaks may arise from spinal dural weakness or recent trauma [6]. Small defects or perforations in the thecal sac play a significant role in spontaneous IH cases. Some individuals may have connective tissue anomalies that predispose them to such defects [7]. The literature also suggests that minor insults, such as those caused by physical activity or the Valsalva maneuver, play a significant role in spinal leakage. In cases involving traumatic events, heightened fragility at nerve root sleeves, along with diverticula formation, contributes to CSF loss along the spinal column [8].

This study establishes a cause-and-effect relationship between chiropractic manipulation and IH syndrome. The therapist incorporates repetitive maneuvers that can extend the joint element beyond its typical range of motion. Generally, stronger manipulations may be applied, particularly in younger patients, thereby increasing the risk of iatrogenic injury to the spinal segment [9]. The patient reported undergoing a vigorous manipulation that included motions of extension, flexion, rotation, or lateral flexion of the neck. Another perspective suggests that the CSF fistula was localized to the specific site of the cervical manipulation. Consequently, a reasonable assumption is that the chiropractic intervention induced a mechanical strain at the level of the cervical root sleeves, leading to disruption in the leptomeninges.

A previous study indicated that chiropractic manipulation was a trigger for the development of symptoms and signs in

patients who subsequently developed IH [10]. The age range of these patients was 29 to 54 years, with women being affected more frequently than men. Similar to the current case, all enrolled subjects initially experienced a distinctive orthostatic headache. None of the subjects, including the present patient, had a history of cranial-cervical trauma or any spine procedure. Additionally, in that study, a temporal correlation was observed between the chiropractic intervention and the onset of clinical manifestations. The median time from the manipulation to symptom onset was 24 hours (range, 0–168 hours) [11]. Furthermore, no significant differences were observed in the biomechanics of forces applied to patients who underwent multi-axial therapy involving the vertebrae and those who received manipulation at the cranial-cervical junction.

On MRI, the patient exhibited characteristic features of IH, including subdural hygroma and meningeal enhancement. However, for cases lacking radiographic evidence during symptom onset, additional scans of the spine can be beneficial in identifying CSF fistulas. Spinal MRI with myelographic sequences is employed to identify meningeal cysts or other anomalies and to delineate the secondary effects of CSF depletion, such as engorged epidural veins, extra-axial fluid collection, and dural enhancement [3,5,12]. Traditionally, invasive myelography has been utilized as a localization procedure for spinal CSF leaks in patients experiencing posture-related headaches [13]. Among 13 reports on IH after spinal chiropractic manipulation, only 7 patients underwent myelography ( $n = 4$ ) or cisternography ( $n = 3$ ). Among these cases, five demonstrated leakage detected at the cervical ( $n = 2$ ), thoracic ( $n = 2$ ), and lumbar ( $n = 1$ ) levels [14]. Consequently, this report is the third to radiologically detect CSF leakage at the potential point of injury in the cervical root sleeves due to spinal mobilization.

Because most spinal leaks tend to resolve spontaneously, the first-line medical approach includes interventions such as bed rest, fluid supplementation, caffeine, and pain medications. This therapy is maintained for several days, especially for IH patients with clear consciousness [15]. Postural symptoms usually subside, albeit rather gradually, once intracranial pressure has returned to normal. However, the decision to continue this conservative management should take into account the patient's preferences. In patients with medically intractable IH, those with recurrent symptoms may opt for an EPB, as reported in some cases [16,17]. In rare clinical scenarios where a bony spur or spinal disc penetrates the dura, surgical intervention may be necessary to close or ligate the leaks [18].

While there is no standardized approach for chiroprac-

tic-induced IH, therapy typically begins with hydration and analgesia to alleviate symptoms, as observed in the current case. Reviewing the literature on this rare condition reveals that conservative strategies have been both intuitive and successful. The expected time for recovery after supportive measures ranged from 12 to 14 days [19,20]. However, if patients remain symptomatic beyond two weeks, they may eventually undergo 1 to 3 non-directed EPBs. These patches are applied initially or additionally, and symptom recovery has been achieved in IH cases associated with spinal chiropractic manipulation [11,14]. If a patient continues to experience symptoms after EPBs, CSF localization studies and a directed EPB should be considered. It's important to emphasize that a reduction in symptoms can be achieved through an immediate and targeted EPB for cases with defined leaking sites, as demonstrated in this patient. Initiating this minimally invasive treatment allows clinicians to provide early pain relief and facilitate a return to work in specific patients with CSF leaks following cervical manipulation.

This case emphasizes the occurrence of IH as a complication of chiropractic management for musculoskeletal pain. With the increasing utilization of cervical manipulation by chiropractors and other medical practitioners, understanding serious therapy-induced harm is crucial for both chiropractors/other medical practitioners and patients. The author recommends a thorough questioning of the patient about the history of chiropractic manipulation in those presenting with orthostatic headaches and intracranial subdural effusions. This awareness can contribute to the elimination of additional, expensive, and unnecessary examination and procedures for diagnosis and treatment.

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## Ethics approval

This case was reviewed and approved by the Institutional Review Board of Keimyung University Dongsan Hospital (IRB No. 2023-09-029). The requirement for informed consent was waived by the board.

## Conflict of interest

The author has nothing to disclose.

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