International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Unmasking Spontaneous Intracranial Hypotension: Radiologic Clues to a Hidden CSF Leak

Dr. Vishnupriya[1], Dr. Rudresh Hiremath[2], Dr. Sreedivya[3]

[1]Post Graduate, Department of Radio Diagnosis, Narayana Medical College, Nellore, Andhrapradesh
Email: peranduruvishnupriya[at]gmail.com

[2]Professor, Department of Radio Diagnosis, Narayana Medical College, Nellore, Andhrapradesh
Email: *rudreshhiremath65[at]gmail.com*

[3]Assistant Professor, Department of Radio Diagnosis, Narayana Medical College, Nellore, Andhrapradesh
Email: *sreedivya.nagam[at]gmail.com*

Abstract: ***Background*: Spontaneous intracranial hypotension (SIH) is an increasingly recognised yet frequently under diagnosed cause of orthostatic headache resulting from spontaneous cerebrospinal fluid (CSF) leakage along the spinal dura. Reduction in CSF volume leads to characteristic intracranial imaging findings secondary to compensatory venous dilation and downward displacement of intracranial structures. Magnetic resonance imaging (MRI) of the brain serves as the primary diagnostic modality and typically demonstrates diffuse pachymeningeal enhancement, venous sinus engorgement, pituitary enlargement, and features of brain sagging such as reduced mamillopontine distance and pontomesencephalic angle. However, precise localisation of the CSF leak may remain difficult on MRI alone. CT cisternography plays a complementary role by enabling direct visualisation of dural defects and active CSF extravasation. *Case presentation*: We present a case of a 55-year-old female with chronic orthostatic headache in whom MRI demonstrated classical intracranial findings of SIH, while CT cisternography accurately localised a dural defect at the atlantoaxial region. This case highlights the importance of a multimodality imaging approach in the diagnosis and targeted management of spontaneous intracranial hypotension.***

Keywords: spontaneous intracranial hypotension, cerebrospinal fluid leak, MRI brain, CT cisternography, pachymeningeal enhancement

1. Introduction

Spontaneous intracranial hypotension (SIH) is an important and increasingly recognised cause of orthostatic headache resulting from spontaneous leakage of cerebrospinal fluid (CSF) along the spinal dura mater. The underlying pathophysiology involves reduction in CSF volume rather than pressure alone, leading to compensatory changes within the cranial vault according to the Monro–Kellie doctrine [1,2].

The hallmark clinical manifestation of SIH is orthostatic headache that worsens in the upright position and improves on recumbency. Associated symptoms may include neck pain, nausea, tinnitus, diplopia, and cranial nerve dysfunction. Due to the nonspecific nature of these symptoms and overlap with other headache disorders, diagnosis is frequently delayed [2,7].

Magnetic resonance imaging (MRI) of the brain plays a pivotal role in diagnosis and demonstrates characteristic findings including diffuse pachymeningeal enhancement, venous sinus engorgement, enlargement of the pituitary gland, subdural fluid collections, and downward displacement of intracranial structures commonly referred to as brain sagging [3,4]. Quantitative imaging markers such as reduced mamillopontine distance and decreased pontomesencephalic angle further support the diagnosis.

Although spinal MRI may reveal epidural fluid collections or abnormal signal intensity along the spinal canal, precise localisation of the CSF leak often remains challenging. CT cisternography serves as a complementary imaging modality that allows direct visualisation of contrast extravasation through dural defects and provides accurate localisation of the site of leakage [4,5].

2. Case Report

A 55-year-old female presented with a one-year history of persistent headache. The headache was diffuse and progressive in nature, worsening in the upright position and partially relieved on lying down. There was no history of trauma, lumbar puncture, or previous neurosurgical intervention.

3. Imaging Findings

MRI Findings
MRI of the brain demonstrated diffuse pachymeningeal thickening and enhancement were observed along the cerebral convexities. The pituitary gland appeared enlarged with associated thickening of the pituitary stalk,

Venous sinus engorgement was also evident with bulging of the inferior border of the transverse sinus. Additional findings included reduced mamillopontine distance and decreased pontomesencephalic angle, indicating downward displacement of the brainstem structures. T2-weighted sequences further demonstrated hyper-intense signal changes along the posterior cervical region with incomplete suppression on FLAIR imaging, raising suspicion for a spinal CSF leak.

CT Cisternography: To confirm and localise the site of CSF leakage, CT cisternography was performed. The study

demonstrated a focal dural defect along the lateral wall of the cervical spine near the atlantoaxial joint. Contrast extravasation was visualised at this site, confirming active CSF leakage corresponding to the abnormal signal region detected on MRI.

4. Discussion

Spontaneous intracranial hypotension most commonly results from spontaneous spinal CSF leaks arising from dural tears, ruptured meningeal diverticula, or structural weakness of the dura mater. Connective tissue disorders have also been implicated as potential predisposing factors [1,7].

The pathophysiology is primarily related to loss of CSF volume. According to the Monro–Kellie doctrine, the cranial cavity maintains a constant total volume composed of brain tissue, blood, and CSF. Reduction in CSF volume therefore leads to compensatory venous dilation and engorgement, producing the characteristic imaging findings observed in SIH [2,3]. Early diagnosis of SIH is crucial, as untreated intracranial hypotension may result in complications including subdural hematomas, cranial nerve palsies, and chronic neurological deficits.

Diagnosis is frequently delayed due to variable clinical presentation and overlap with other headache disorders. Early recognition is essential, as prolonged hypotension may lead to complications including subdural collections and cranial nerve dysfunction.

Recent Neuro radiology studies have emphasised the value of advanced multimodality imaging algorithms in improving the detection of spinal CSF leaks and guiding targeted therapy [9,11,12].

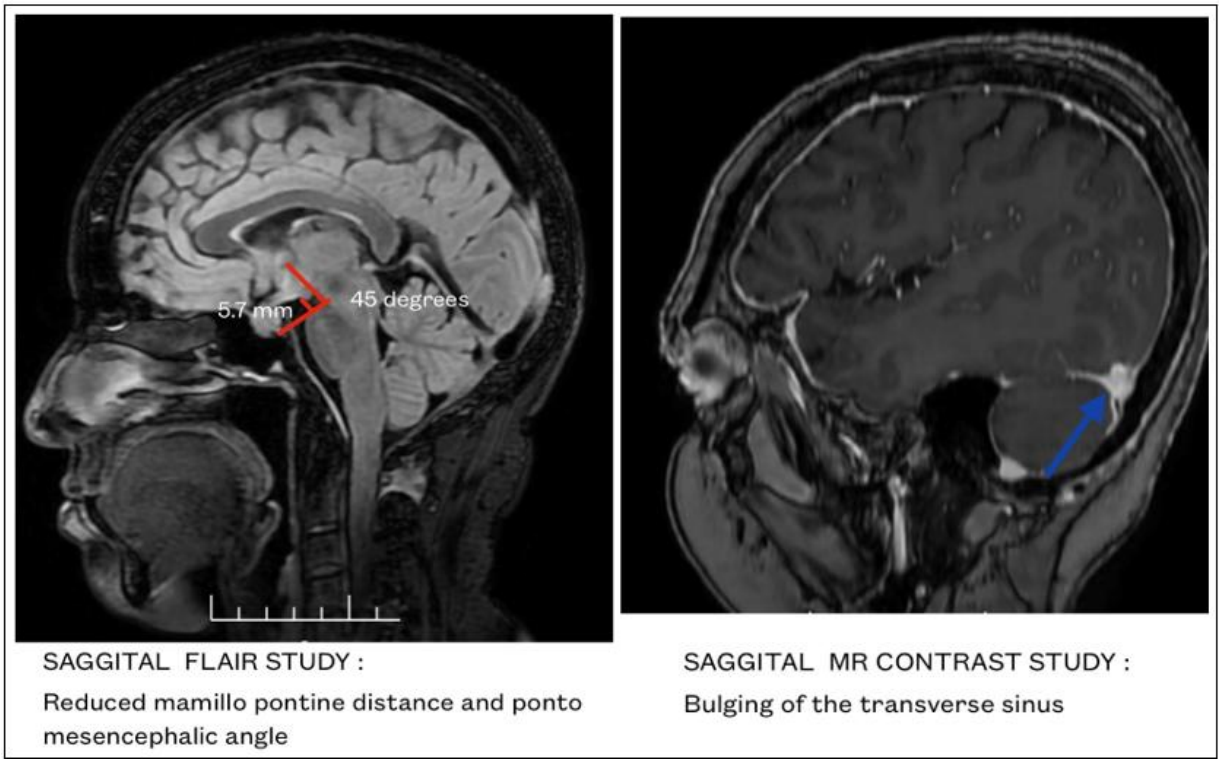
Management

Cerebrospinal fluid leakage is initially managed with conservative measures including bed rest, hydration, caffeine, and analgesia. In patients with persistent symptoms, an **epidural blood patch** is the treatment of choice, restoring CSF pressure by sealing the dural defect. Targeted patches have higher success rates, while surgery is reserved for refractory cases.In this patient epidural blood patching was performed, concurrently the patient symptoms were relieved

5. Conclusion

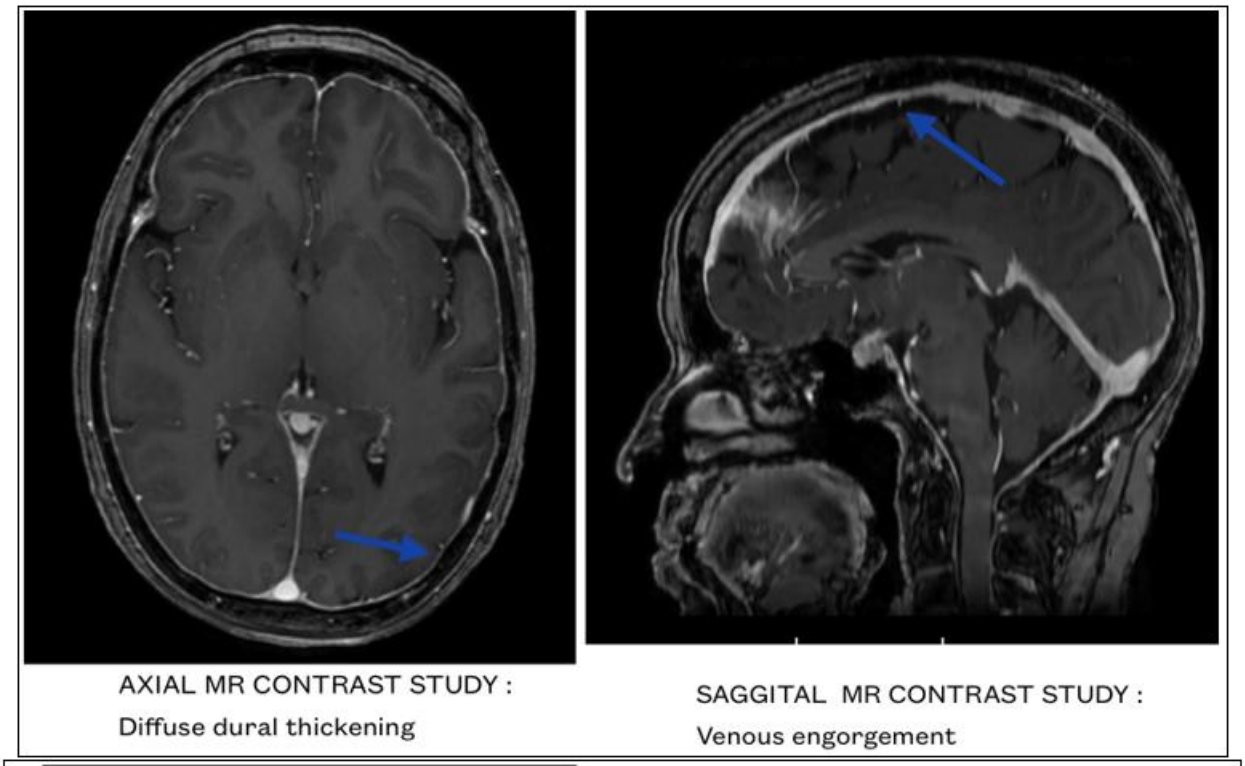
Spontaneous intracranial hypotension represents an important and potentially reversible cause of orthostatic headache. MRI demonstrates characteristic intracranial findings including diffuse pachymeningeal enhancement, venous sinus engorgement, pituitary enlargement, and brain sagging features. However, precise localisation of the underlying cerebrospinal fluid leak may remain challenging using MRI alone. CT cisternography serves as a valuable complementary modality by accurately identifying dural defects and sites of active CSF leakage. A multimodality imaging approach therefore plays a crucial role in early diagnosis, targeted treatment, and improved clinical outcomes in patients with spontaneous intracranial hypotension

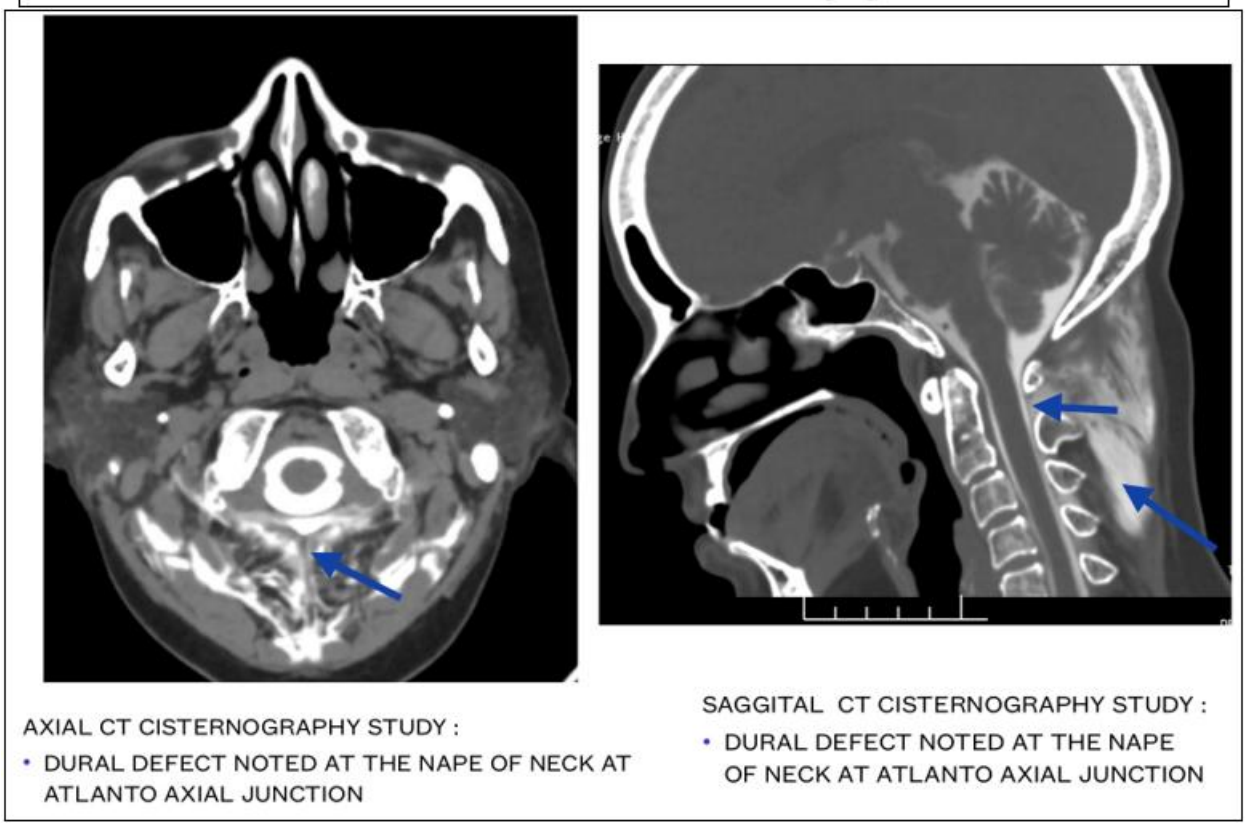
6. Image Gallery:



SAGGITAL FLAIR STUDY :
Reduced mamillo pontine distance and ponto mesencephalic angle

SAGGITAL MR CONTRAST STUDY :
Bulging of the transverse sinus





Imaging Teaching Points

- Spontaneous intracranial hypotension should be suspected in patients presenting with orthostatic headache and MRI findings such as diffuse pachymeningeal enhancement, venous sinus engorgement, pituitary enlargement, and brain sagging.
- Quantitative measurements such as reduced mamillopontine distance and decreased pontomesencephalic angle provide objective indicators of intracranial hypotension.
- Spinal MRI may demonstrate indirect signs of CSF leakage, although precise leak localisation often requires additional imaging.
- CT cisternography enables direct visualisation of dural defects and contrast extravasation, making it valuable for accurate localisation of CSF leaks.

References

[1] Schievink WI. Spontaneous spinal cerebrospinal fluid leaks and intracranial hypotension. JAMA. 2006;295(19):2286-2296.
[2] Mokri B. Spontaneous intracranial hypotension. Curr Neurol Neurosci Rep. 2001; 1(1): 109-117.
[3] Farb RI, Forghani R, Lee SK, Mikulis DJ, Agid R, Willinsky RA, et al. The spinal MR imaging findings of intracranial hypotension. AJNR Am J Neuroradiol. 2005;26(4):707-713.
[4] Kranz PG, Tanpitukpongse TP, Choudhury KR, Amrhein TJ. Imaging signs in spontaneous intracranial hypotension. AJNR Am J Neuroradiol. 2016;37(7):1374-1378.
[5] Schievink WI, Maya MM, Louy C, Moser FG, Tourje J. Diagnostic criteria for spontaneous spinal CSF leaks. AJNR Am J Neuroradiol. 2008;29(5):853-856.
[6] Beck J, Gralla J, Fung C, et al. Spinal CSF leak as the cause of chronic intracranial hypotension. J Neurosurg. 2016;124(4):912-920.
[7] Bond KM, Benson JC, Cutsforth-Gregory JK, et al. Spontaneous intracranial hypotension: atypical radiologic appearances and mimickers. AJNR Am J Neuroradiol. 2020;41(8):1339-1347.
[8] Govindappa SKG, Adiga CP, Kumar S, et al. Spontaneous intracranial hypotension: a review of neuroimaging. Indian J Radiol Imaging. 2023;34(1):128-138.
[9] Farnsworth PJ, Madhavan AA, Verdoorn JT, et al. Spontaneous intracranial hypotension: updates from diagnosis to treatment. Neuroradiology. 2023;65(2):233-243.
[10] Cheema S, Mehta D, Qureshi A, et al. Spontaneous intracranial hypotension. Pract Neurol. 2024; 24(2): 98-105.
[11] Kranz PG, Amrhein TJ, Brinjikji W, et al. Consensus guidelines on diagnostic brain and spine imaging of spontaneous intracranial hypotension. AJNR Am J Neuroradiol. 2025; 46: 2457- 2467.
[12] Kang CH, Madhavan AA, Benson JC, et al. MRI scoring systems in spontaneous intracranial hypotension. AJNR Am J Neuroradiol. 2025; 46: 1925-1930.