CASE SERIES

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Radiological Imaging in Idiopathic Intracranial Hypertension: A Case Series

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ABSTRACT

Background: Idiopathic Intracranial Hypertension (IIH), or pseudotumor cerebri, is characterized by elevated intracranial pressure without a detectable secondary cause. The condition has an estimated incidence of 0.9 per 100,000 in the general population, rising to 19 per 100,000 among obese women of reproductive age. IIH is associated with significant morbidity, particularly vision loss, if not diagnosed and managed promptly.

Methodology: This retrospective case series analyzed five patients evaluated between May 2024 and May 2025 who met the modified Dandy criteria for IIH and underwent standardized MRI and MRV protocols. Patient selection involved the exclusion of secondary intracranial hypertension, and two radiologists independently reviewed images.

Results: All patients (100%) exhibited either partial or complete empty Sella, 80% (4/5) showed transverse sinus stenosis, 60% (3/5) had Meckel's cave enlargement; and 60% (3/5) had perioptic CSF space dilation; visual disturbances correlated with perioptic CSF distention. The study highlights the value of neuroimaging biomarkers in confirming IIH, guiding clinical management, and differentiating from secondary causes. However, the limited sample size and single-center scope restrict generalizability.

Conclusion: Early radiological identification and intervention are crucial to prevent irreversible complications, emphasizing the need for multi-disciplinary care and further research involving advanced imaging and long-term outcomes.

Keywords: Idiopathic intracranial hypertension, MRI, MRV, Empty Sella, transverse sinus stenosis, pseudotumor cerebri, papilledema, neuroimaging biomarkers

INTRODUCTION

Idiopathic Intracranial Hypertension (IIH), also called pseudotumor cerebri, is a disorder marked by elevated intracranial pressure (ICP) with no identifiable cause on imaging or cerebrospinal fluid (CSF) analysis.[1] The annual incidence is estimated 0.9 per 100,000 persons but rises to 19 per 100,000 in obese women of childbearing age.[2] Recent data from North American and European cohorts reaffirm the predilection for females and reinforce obesity as a primary risk factor.

Pathophysiology: The etiology of IIH is multifactorial, involving disordered CSF absorption or dynamics and, occasionally, venous outflow obstruction at the level of the transverse sinuses.[3] Anatomical variations, hormonal influences (particularly in females), and metabolic derangements (such as those related to obesity) are implicated. MRV studies often show sinus stenosis, but whether this is primary or secondary to raised ICP remains debated.[4]

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The diagnosis of idiopathic intracranial hypertension (IIH) is established using the modified Dandy criteria[5], which include the presence of signs and symptoms of raised intracranial pressure such as headache, papilledema, and visual disturbances; the absence of focal neurological deficits except for sixth nerve palsy; normal neuroimaging findings aside from features suggestive of raised intracranial pressure such as empty sella, globe flattening, dilated perioptic cerebrospinal fluid (CSF) spaces, or venous sinus stenosis; an elevated lumbar puncture opening pressure greater than 25 cm H_2O with normal CSF composition; and the exclusion of alternative causes of intracranial hypertension.

Differential diagnoses include secondary intracranial hypertension due to medications (e.g., tetracyclines, vitamin A), endocrine disorders (e.g., hypothyroidism, Cushing's syndrome), venous sinus thrombosis, hydrocephalus, or space-occupying lesions.[6] Imaging with MRI and MRV is crucial for differentiating IIH from these causes by excluding gross structural abnormalities and confirming subtle features of raised ICP.[7]

Advancements over the past decade have refined IIH diagnosis, with 3T MRI and high-resolution post-contrast MRV enhancing detection of subtle venous stenoses and optic nerve changes.[8] Automated software and artificial intelligence now show growing promise in quantifying optic nerve sheath diameter and CSF volumes, aiding standardization and reproducibility.

MATERIALS AND METHODS

This retrospective case series was conducted between May 1, 2024, and May 31, 2025, following approval by the Institutional Review Board. Given the retrospective nature of the study, the requirement for informed consent was waived. Patients presenting to the neurology department with chronic headache and imaging features consistent with idiopathic intracranial hypertension (IIH) were included. Individuals with intracranial mass lesions, hydrocephalus, venous sinus thrombosis, or any alternative diagnosis were excluded to ensure diagnostic homogeneity.

All participants underwent a standardized imaging protocol that included MRI of the brain with diffusion-weighted imaging (DWI), T1-weighted, T2-weighted, fluid-attenuated inversion recovery (FLAIR), and susceptibility-weighted imaging (SWI) sequences; MRI of the orbit with T2 sagittal and T1 post-contrast sequences; and MR venography using either time-of-flight or contrast-enhanced techniques. Imaging was performed on a 1.5T Philips Ambition X scanner, and datasets were reconstructed and reviewed using the Philips IntelliSpace Portal Workstation.

Image analysis was performed independently by two radiologists with 8-10 years of experience in MRI interpretation, who were blinded to each other's findings. Interobserver agreement was assessed using the kappa statistic to evaluate the consistency of radiological interpretations across observers, thereby ensuring reliability and objectivity of the imaging assessments.

RESULTS

Individual Narratives

Case 1: A middle-aged obese female presented with a longstanding history of recurrent headache and paresthesia. Cerebrospinal fluid (CSF) analysis revealed mildly elevated opening pressure. Magnetic resonance imaging (MRI) demonstrated a partial empty sella. The patient was initiated on medical management, following which her symptoms showed significant improvement.

Case 2: A young female experienced progressive visual loss over an 8-month duration. Fundoscopic evaluation initially revealed papilledema, which subsequently progressed to optic atrophy. MRI showed severe perioptic CSF space dilation with associated enlargement of Meckel's cave. Given the severity of visual compromise, she was referred for optic nerve sheath fenestration.

Table 1: Case Presentations

Case	Age/ Sex	BMI (kg/m²)	Presentation	LP Opening Pressure	Imaging Findings	Treatment	Follow-up Outcome
1	59/F	33	Headache, tingling	28 cm H_2O	Partial empty sella, bilateral transverse sinus stenosis	Acetazolamide, Amitriptyline	Mild headache at 6 months
2	32/F	36	Headache, vision loss, disc pallor (optic atrophy from chronic IIH)	32 cm H_2O	Empty sella, prominent perioptic CSF, Meckel's cave enlargement	Acetazolamide, optic nerve sheath fenestration	Improved vision, stable papilledema
3	32/F	31	Hemicranial headache, papilledema	29 cm H_2O	Empty sella, transverse sinus stenosis, Meckel's cave enlargement	Acetazolamide	Symptom resolution
4	60/F	29	Headache, dizziness, impaired vision	27 cm H_2O	Empty sella, perioptic CSF, transverse sinus stenosis	Acetazolamide	Stable, improved dizziness
5	29/M	28	Throbbing headache, giddiness	30 cm H_2O	Empty sella, perioptic CSF, transverse sinus stenosis, Meckel's cave enlargement	Acetazolamide	Partial improvement

Case 3: This patient presented with unilateral headache accompanied by documented papilledema. CSF studies confirmed markedly raised intracranial pressure (ICP), and neuroimaging findings were consistent with the classic features of idiopathic intracranial hypertension (IIH). The patient was promptly started on acetazolamide therapy, resulted in complete remission of symptoms.

Case 4: An elderly female reported chronic headache with associated visual disturbances. Imaging studies revealed evidence of both perioptic CSF space dilation and transverse venous sinus stenosis. She was managed conservatively with low-dose medical therapy, on which she has remained clinically stable.

Case 5: A young male presented with throbbing headache and recurrent episodes of giddiness. Notably, IIH is relatively uncommon in males, comprising less than 10% of reported cases. His CSF opening pressure was moderately elevated. Although he responded to acetazolamide, his symptomatic relief was only partial, with some residual complaints persisting.

The clinical profile of the study cohort demonstrated a mean age of 42.4 years, with a range of 29 to 60 years, reflecting a middle-aged population. A clear female predominance was observed, with four out of five patients (80%) being women. The mean body mass index (BMI) was 31.4 kg/m² (range: 28-36 kg/m²), indicating that the majority of patients were overweight or obese, a well-recognized risk factor for idiopathic intracranial hypertension (IIH). All patients presented with chronic headache (100%), while additional symptoms included visual disturbances in two patients (40%), papilledema in two patients (40%), and dizziness or giddiness in two patients (40%), underscoring the heterogeneous clinical manifestations of IIH.

Neuroimaging findings revealed distinct radiological markers consistent with IIH. Empty sella was observed in all patients (100%), with partial expression in one case (20%) and complete expression in four cases (80%). Transverse sinus stenosis was detected in four patients (80%), of which three (60%) had bilateral involvement.

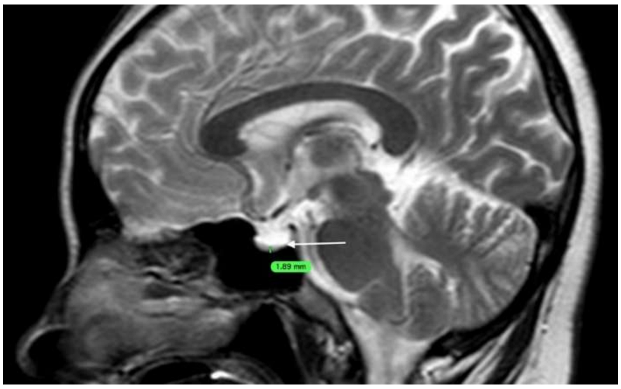

Figure 1: Sagittal T2-weighted MRI of the sella turcica demonstrating an empty sella. The pituitary gland height measures 1.9 mm (normal range: 4-8 mm), with cerebrospinal fluid (CSF) occupying the sella

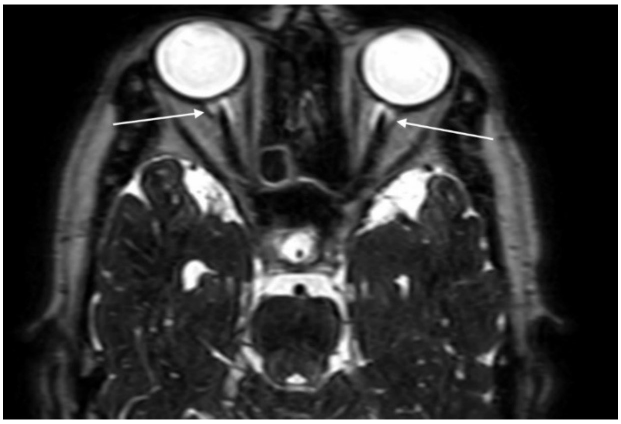

Figure 2: Axial T2 MRI orbits: Dilated perioptic CSF (more than 2mm)

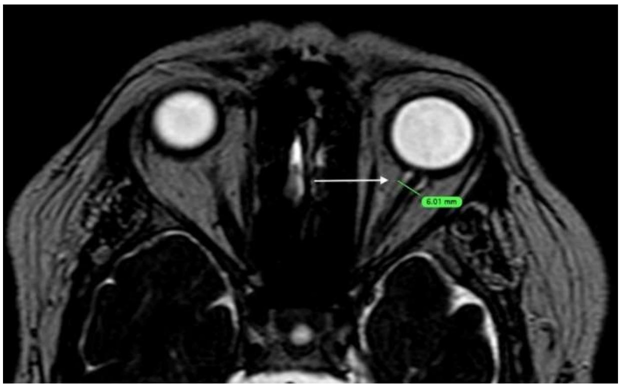

Figure 3: Axial T2-weighted MRI of the orbits displaying increased optic nerve diameter measuring >5.3-6 mm measured 3 mm posterior to the globe) consistent with papilledema due to raised intracranial pressure.

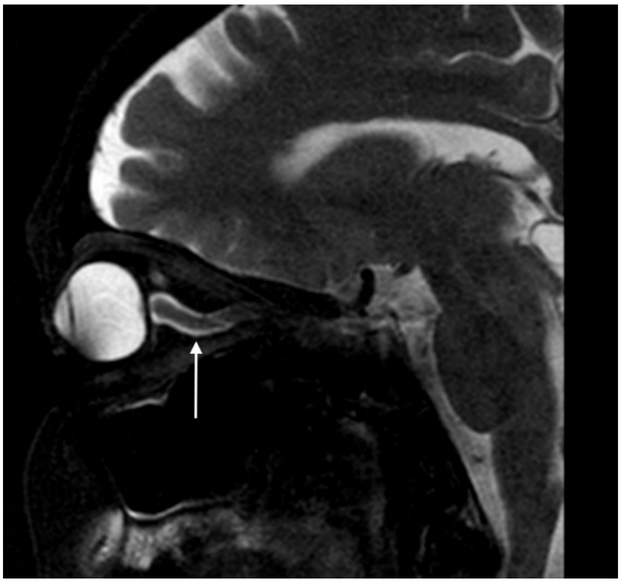

Figure 4: Oblique sagittal T2: Marked vertical tortuosity of the optic nerve on the left (arrow)

Perioptic cerebrospinal fluid (CSF) space dilation was present in three patients (60%), with a mean perioptic CSF diameter of 2.5 mm (SD: 0.18 mm). Similarly, Meckel's cave dilation was noted in three patients (60%).

Importantly, a strong clinical-radiological correlation was observed, as visual disturbances were reported exclusively among patients with perioptic CSF dilation (100% of this subgroup).

Lumbar puncture demonstrated elevated opening pressures across the cohort, with a mean of 29.2 cm H_2O (range: 27-32; SD: 1.92), further reinforcing the diagnosis of IIH. Inter-observer agreement between the two radiologists assessing MRI and CSF-related features was excellent, with a kappa value of 0.86, indicating high reliability and consistency in imaging interpretation. Together, these clinical and radiological findings highlight the characteristic demographic profile and imaging spectrum of IIH in this cohort.

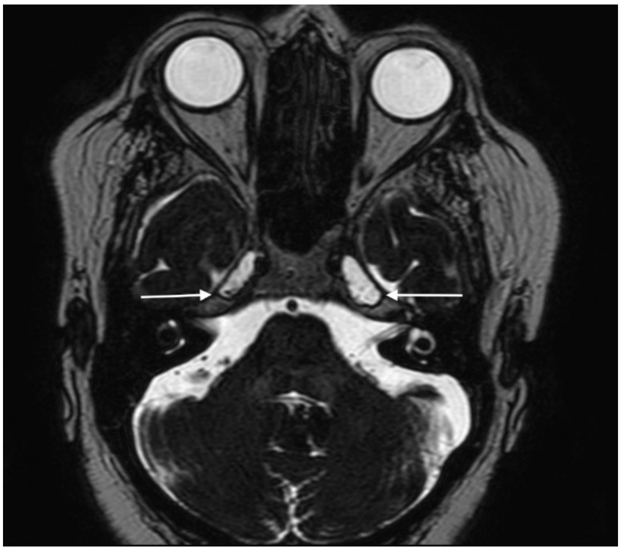

Figure 5: Axial T2 DRIVE sequence demonstrating dilatation of the bilateral Meckel's caves (arrow)

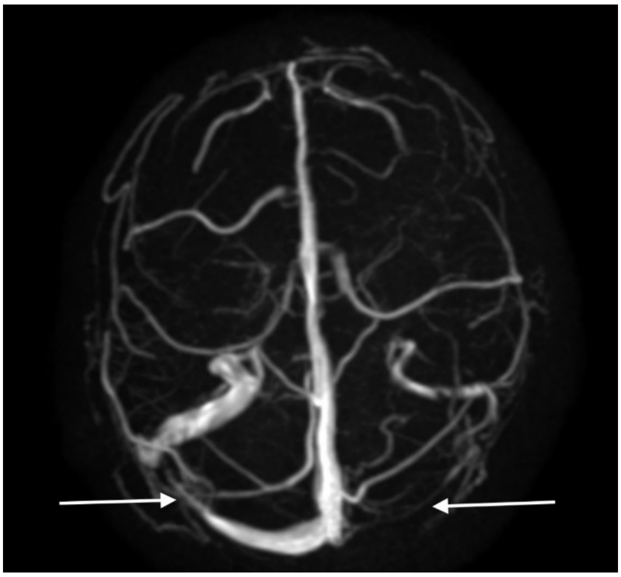

Figure 6: Axial magnetic resonance venography (MRV) maximum intensity projection (MIP) image showing focal stenosis of the right transverse sinus and complete stenosis of the left transverse sinus.

DISCUSSION

This case series demonstrates imaging findings consistent with previous larger studies: empty sella in all patients, transverse sinus stenosis in 80% (vs. 90% reported by Bidot et al[9], and perioptic CSF dilation in 60%, supporting their roles as neuroimaging biomarkers of IIH [10]. The relationship between sinus stenosis and IIH remains controversial recent reviews debate if stenosis is a cause or consequence, with stenting showing benefit in select cases.[11] The application of high-resolution MRI and post-processing validates characteristic features and may offer even greater sensitivity than conventional methods.[12] Limitations include small sample size, possible selection bias, and absence of longitudinal imaging follow-up. Future directions should assess automated image analysis via AI and prospective studies linking imaging to therapeutic outcomes.

CONCLUSION

MRI and MRV provide highly sensitive biomarkers for diagnosing IIH, facilitating exclusion of secondary etiologies and allowing early intervention. Prompt radiological recognition of empty sella, perioptic CSF dilation, and transverse sinus stenosis can guide clinical approaches, including weight management, acetazolamide, and surgical options such as optic nerve sheath fenestration or venous sinus stenting. The strong correlation between imaging findings (especially in those with vision disturbances) underlines the importance of neuroimaging in determining prognosis and treatment. Multidisciplinary management by neurologists, radiologists, and ophthalmologists is essential. Larger, multi-center, and prospective studies should be prioritized to define best imaging protocols and predict treatment response, with an emphasis on vision preservation and quality of life in IIH patients.

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