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Neuro-Ophthalmic Presentations in Patients with IIH: Role of CSF Pressure, Imaging and Visual Function Testing

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Abstract **Original Research Article**

Background: Idiopathic intracranial hypertension (IIH) is a disorder of elevated intracranial pressure without secondary causes, primarily affecting young, obese women. Although headache and visual impairment are hallmark features, the link between cerebrospinal fluid (CSF) pressure, neuro-ophthalmic findings, and visual prognosis remains unclear. This study evaluated neuro-ophthalmic presentations of IIH and analyzed associations between CSF pressure, imaging findings, and visual function testing in patients with IIH. ***Methods:*** This cross-sectional study included 100 patients with IIH at the National Institute of Neuro Sciences & Hospital, Dhaka, Bangladesh, from July 2022 to June 2025. Demographic and clinical data, CSF opening pressure, imaging results, and ophthalmological evaluations (fundal photography and perimetry) were collected. Statistical analyses, including chi-square tests and logistic regression, were conducted using SPSS version 25.0, with a significance threshold of $p < 0.05$. ***Results:*** The mean age was 26.16 ± 7.49 years, with female predominance. Headache (97%), papilledema (93%), and visual impairment (88%) were the most common symptoms. CSF pressure > 25 cm was noted in 64% of patients and showed a statistically significant association with visual loss (p=0.02), but not with double vision (p=0.96), tinnitus (p=0.51), papilledema (p=0.56), or cranial nerve palsy (p=0.41). Imaging abnormalities were rare (4%). Logistic regression revealed no significant predictive value for CSF pressure >25 (OR 0.13, p=0.06) or perimetry (OR 1.66, p=0.49) for visual impairment. ***Conclusion:*** IIH frequently presents with visual impairment and papilledema; however, CSF pressure alone cannot predict IIH. Multimodal evaluation with ophthalmic assessment and imaging is essential for risk stratification and management.

Keywords: Idiopathic intracranial hypertension, CSF pressure, papilledema, visual impairment.

INTRODUCTION

Idiopathic intracranial hypertension (IIH) or pseudotumor cerebri is a disease that exhibits increased intracranial pressure with no known cause that affects mostly young obese women [1,2]. All over the world, the incidence of IIH rises in parallel with the increased prevalence of obesity, with the latest population-based studies estimating an occurrence of 4.7 per 100,000 in obese females in the childbearing ages of 15-49 years [3]. Its clinical significance lies in the likelihood of permanent visual loss and compromised quality of life in the absence of delays in its diagnosis and treatment [4,5].

The pathophysiology of IIH is not fully understood yet, and a variety of mechanisms associated

with the impaired cerebrospinal fluid (CSF) absorption, cerebral venous sinus stenosis, hormonal dysregulation, and glymphatic dysfunction are mentioned [6,7]. The most common presenting symptom is headache that is present in more than 90 percent of patients, and papilledema and related visual disturbances are characteristic features [8]. Sometimes, there is also cranial nerve palsy and tinnitus. Although there have been developments in the neuroimaging and diagnostic methods, there is still controversy regarding the correlation of the CSF opening pressure, neuro-ophthalmic manifestations, and visual prognoses [9].

A number of studies have been conducted to investigate the clinical and radiological characteristics of IIH patients. Sharma et al. focused on the fact that visual impairment is high in frequency at presentation, and Mollan et al. pointed to the significant connection between intracranial pressure and the severity of headaches [10,11]. There is, however, scarce information on South Asian populations, where epidemiological and demographic causes might affect the expression of diseases. Furthermore, studies on the predictive factors in visual outcomes in IIH, particularly ancillary investigations like perimetry and fundal photography, also need to be investigated.

Moreover, recent studies have indicated that the degree of neuro-ophthalmic symptoms is not necessarily connected with the upsurge of CSF pressure, and one should doubt the relevance of CSF measures in everyday clinical practice [12]. Although both MRI and MRV techniques are pursued in order to establish some supportive diagnostics, they are not indicative of IIH-relevant abnormalities exceedingly well [13]. In the light of these uncertainties, it is critical to assess the association among CSF pressure, imaging abnormalities, and visual function testing in IIH patients in diverse clinical localizations.

This study aims to fill this gap to explore the neuro-ophthalmic manifestations of IIH and to discuss the role of CSF pressure, imaging results, and visual function testing in a group of patients in Bangladesh. This research is expected to provide new evidence to guide clinical decision-making, early diagnosis, and management of IIH to avoid permanent visual impairment.

METHODOLOGY & MATERIALS

This cross-sectional study was conducted at the Department of Neurology, National Institute of Neuro Sciences & Hospital, Dhaka, Bangladesh, from July 2022 to June 2025. A total of 100 patients diagnosed with IIH were included. The study population comprised patients aged 18–50 years presenting with neuro-ophthalmic symptoms.

Inclusion Criteria:

- Age 18–50 years.
- Diagnosis of IIH confirmed by Friedman criteria.
- Presence of neuro-ophthalmic symptoms (headache, papilledema, cranial nerve palsy, or visual impairment).
- Willingness to provide informed consent.

Exclusion Criteria:

- Secondary intracranial hypertension (e.g., venous sinus thrombosis, space-occupying lesions).
- History of optic neuropathy unrelated to IIH.
- Previous neurosurgical intervention for raised intracranial pressure.
- Incomplete clinical or imaging data.

Data Collection and Study Procedure:

Data were collected through structured clinical evaluations, including detailed history, neurological examination, and ophthalmological assessment. CSF opening pressure was measured via lumbar puncture. Imaging studies (MRI/MRV) were performed to rule out secondary causes. Visual function testing included fundal photography and perimetry. All procedures were standardized to ensure accuracy and reproducibility. Data were recorded using pre-designed case report forms and subsequently validated through cross-checking by two independent investigators to maintain reliability and consistency. Informed consent was obtained from all participants. Patient confidentiality was strictly maintained by anonymizing data and restricting access to authorized personnel only.

Statistical Analysis:

Data were analyzed using SPSS version 25.0. Descriptive statistics were used to summarize demographic and clinical data. Chi-square tests and independent t-tests were applied for group comparisons. Logistic regression analysis was performed to identify predictors of visual impairment. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic and Clinical Characteristics of Patients with IIH (n=100)

Characteristics		Frequency	Percentage
Mean Age (years)		26.16±7.49	
BMI	<24.9	31	31.0
	25-29.9	47	47.0
	30-34.9	14	14.0

	≥35	8	8.0
Headache	Yes	97	97.0
	No	3	3.0
Visual impairment	Yes	88	88.0
	No	12	12.0
Papilledema	Present in one eye	2	2.0
	Present in both eyes	93	93.0
	Absent	5	5.0
Elevated CSF opening pressure	Yes	75	75.0
	No	25	25.0
Cranial nerve palsy	Present	50	50.0
	Absent	50	50.0

Table 1 presents the baseline demographic and clinical characteristics of the study population. The mean age was 26.16 ± 7.49 years. The majority of patients (47%) had a BMI between 25 and 29.9 kg/m², while 8% had a BMI ≥ 35. Headache was reported by 97% of patients, while visual impairment was observed in 88%. Papilledema was present in both eyes in 93% of patients, and unilateral papilledema was noted in 2%. Elevated CSF opening pressure was documented in 75% of patients. Cranial nerve palsy was observed in 50% of the study population.

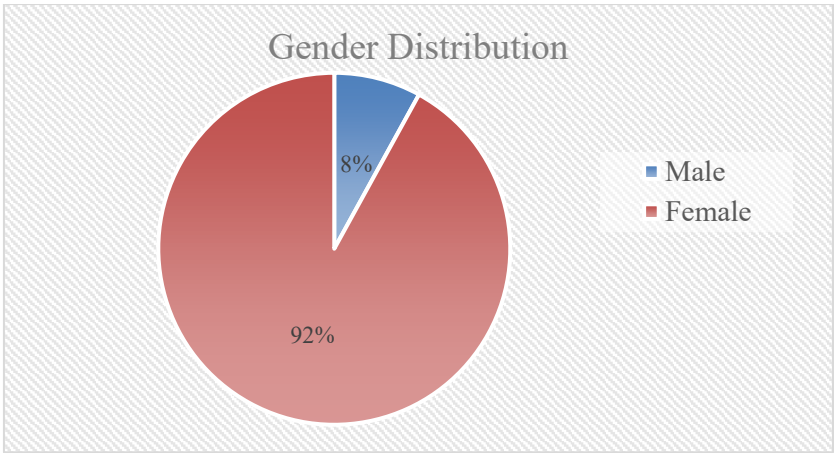

Figure 1: Gender Distribution of the Study Population

Figure 1 illustrates the gender distribution among the study population. The majority of patients were female, highlighting the known predominance of IIH in women.

Table 2: Association Between CSF Pressure and Neuro-Ophthalmic Symptoms

Symptom		**CSF Pressure ≤25 cm (N=36)**	**CSF Pressure >25 cm (N=64)**	***P*-value**
Visual loss	Yes	0	8	0.02
	No	36	56	
Double vision	Yes	24	43	0.96
	No	12	21	
Tinnitus	Yes	13	19	0.51
	No	23	45	
Papilledema	Present in one eye	0	2	0.56
	Present in both eyes	34	59	
	Absent	2	3	
Cranial nerve palsy	Present	20	30	0.41
	Absent	16	34	

Table 2 examines the association between CSF pressure and neuro-ophthalmic symptoms. Statistically significant differences were found between patients with CSF pressure ≤ 25 cm and > 25 cm for visual loss (p=0.02). No statistically significant differences were found between patients with CSF pressure ≤ 25 cm and > 25 cm for double vision (p=0.96), tinnitus (p=0.51), papilledema (p=0.56), or cranial nerve palsy (p=0.41).

Table 3: Imaging and Visual Function Testing

Variable	Frequency (n)	Percentage (%)
Imaging Abnormalities	4	4.0
Fundal Photography Taken	96	96.0
Perimetry Done	30	30.0

Table 3 summarizes imaging and visual function testing data. Imaging abnormalities were identified in 4% of patients. Fundal photography was performed in 96% of cases, while perimetry was conducted in 30% of patients.

Table 4: Logistic Regression for Predictors of Visual Impairment in IIH

Predictor	Adjusted OR (95% CI)	*p*-value
CSF Pressure > 25 cm	0.13 (0.16–1.08)	0.06
Perimetry Yes	1.66 (0.40–6.82)	0.49

Table 4 presents a logistic regression analysis for predictors of visual impairment in IIH. CSF pressure > 25 cm showed an adjusted odds ratio (OR) of 0.13 (95% CI: 0.16–1.08) with a *p*-value of 0.06, indicating a non-significant trend. Perimetry testing was not significantly associated with visual impairment (OR: 1.66, 95% CI: 0.40–6.82, *p*=0.49).

DISCUSSION

This study offers a substantive analysis of neuro-ophthalmic manifestations of idiopathic intracranial hypertension (IIH) patients and the consideration of many factors such as cerebrospinal fluid (CSF) pressure, imaging, and ocular testing of visual functions. These results are consistent with the familiar demographic epidemiology of IIH that shows a dominance of young, obese women, which is in line with the findings of Mollan et al. and Miah et al. [2,3]. This population-based correlation has been attributed to changes in intracranial venous outflow and hormonal imbalance due to obesity that impact the CSF flow [6].

The prevalence of headache was the highest (97%), which is also in line with previous findings describing the incidence of headache in IIH to be over 90% [8]. Mulla et al. have provided exceptional insight into their influential adverse effects on the quality of life, and how they should be identified and controlled as early as possible [5]. Moreover, 88 percent of our patients were visually impaired, which is a similar result to what Sharma et al. observed in visual dysfunction in IIH [10]. These findings support the critical place of ophthalmic surveillance in the assessment of the disease because the most dreaded condition in IIH is visual loss.

A key finding in this study was the significant association between CSF pressure >25 cm and visual loss (*p*=0.02) in univariate analysis. This finding agrees with the observation made by Tutar and Kale, who stated that there might not be a direct correlation of the outcome of visual symptoms with CSF pressure [12]. Domingues et al. also observed that patients with residual visual deficits might exhibit fluctuating CSF pressure values, signifying the possible influence of other factors, including the vulnerability of the optic nerves and glymphatic dysfunction, on visual risks [9]. This result suggests that while CSF pressure may contribute to visual morbidity, its role is likely influenced by additional factors such as optic nerve susceptibility and individual variations in intracranial compliance.

The incidence of cranial nerve palsy was 50%, a higher result compared with previous studies that had recorded rates of between 12 and 30 percent [14]. Such discrepancy can be due to late presentation or lack of recognition of early cranial nerve involvement in resource-limited countries. Although cranial nerve palsy in IIH is traditionally temporary, Ambika et al. reported that its occurrence may signify a more severe disease pathway, requiring an intensified observation [15].

The logistic regression analysis indicated that the CSF pressure > 25 cm was not an independent predictor of visual impairments (OR 0.13, *p*=0.06). This is an agreement with the findings of Tutar and Kale, who observed that CSF pressure alone may not accurately reflect disease severity or long-term visual outcomes. The relationship could be better determined by a future prospective study utilizing a larger sample size.

The fact that only 4 percent of our patients revealed abnormalities on imaging supports the fact that neuroimaging is limited in the diagnosis of IIH, as stated by Wong et al. and Kwee & Kwee [13,16]. Imaging is, however, important to exclude other causes and identify indirect manifestations, namely transverse sinus stenosis [17]. Even though imaging itself does not suffice to make the diagnosis, it is an instrumental additional means when evaluating IIH thoroughly.

This is as reported in our study, where the rate of fundal photography was very high (96%), hence indicating its usefulness as an objective means of assessment of papilledema. Perimetry was done in only 30 percent of patients, probably because of the limited resources. However, perimetric assessment has been demonstrated to be a reliable predictor of the degree of the disease progression, and it should be incorporated into clinical IIH practice [18]. Integration of perimetry with other structural imaging techniques like optical

coherence tomography may provide even better risk stratification, as cited by Agarwal et al. [19].

This study highlights several clinical implications. First, CSF pressure measurement should be interpreted alongside other clinical and ophthalmic parameters to avoid underestimating visual risk. Second, routine visual function testing is indispensable in IIH management. Finally, the absence of a strong correlation between CSF pressure and visual outcomes underscores the need for a multifactorial diagnostic approach, a principle also supported by Hoffmann et al. [20].

LIMITATIONS OF THE STUDY

This study is limited by its cross-sectional design, single-center setting, and lack of longitudinal follow-up, which precludes the assessment of visual outcomes over time. Perimetry was not performed in all patients, potentially leading to an underestimation of visual field involvement.

CONCLUSION

This study demonstrates that neuro-ophthalmic manifestations of IIH are frequent and include a high prevalence of headaches, papilledema, and visual impairment. CSF pressure alone cannot predict IIH, underscoring the need for a comprehensive assessment. Multimodal evaluation using ophthalmic tests and imaging is essential for accurate diagnosis and risk stratification of IIH.

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Conflicts of interest

There are no conflicts of interest.

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