Section: Community-Medicine

Original Research Article

IRON PROFILE STUDIES IN IDIOPATHIC INTRACRANIAL HYPERTENSION AND THEIR ROLE IN CLINICAL OUTCOMES – A SINGLE CENTER OBSERVATIONAL STUDY

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ABSTRACT

Background: Idiopathic Intracranial Hypertension (IIH) is a disorder characterized by elevated intracranial pressure (ICP) in the absence of a mass lesion, hydrocephalus, or identifiable secondary cause. It commonly affects obese women of childbearing age and presents with headaches, transient visual obscurations, diplopia, and papilledema, posing a risk of permanent vision loss if untreated. The underlying pathophysiology remains unclear, but recent studies have suggested a possible association with micronutrient deficiencies, particularly iron deficiency. Iron plays a vital role in oxygen transport, mitochondrial function, and neurotransmission. Iron deficiency, even without overt anemia, has been implicated in neurovascular dysregulation and altered cerebrospinal fluid (CSF) dynamics. However, its role in IIH remains underexplored. Emerging evidence points to a potential link between iron deficiency and increased intracranial pressure through impaired CSF absorption, endothelial dysfunction, and altered venous compliance .Given the lack of standardized data on iron status in IIH patients and its possible prognostic and therapeutic relevance, this study aims to evaluate the iron profile in patients with IIH and correlate it with clinical severity, CSF pressure, visual outcomes, and response to iron correction. Establishing such a relationship may provide novel insights into disease pathophysiology and open up additional avenues for therapeutic intervention.

Materials and Methods: This was an ambispective observational study conducted at a tertiary care neuroscience center over a period of 18 months. Thirty patients diagnosed with idiopathic intracranial hypertension (IIH) based on the Modified Dandy Criteria were included. The study cohort comprised both retrospectively identified and prospectively enrolled patients. Detailed clinical data, visual parameters (visual acuity, fundus examination, optical coherence tomography [OCT], visual fields), lumbar puncture findings (cerebrospinal fluid [CSF] opening pressure), and iron profile parameters (hemoglobin, serum ferritin, serum iron, total iron-binding capacity [TIBC], and transferrin saturation) were recorded at baseline.

All patients initially received standard IIH therapy (acetazolamide ± topiramate ± CSF tapping). In the prospective arm, iron therapy was initiated in iron-deficient patients after two weeks of standard therapy. Patients were followed at 1 and 3 months with reassessment of clinical symptoms (headache, transient visual obscurations, diplopia), ophthalmological evaluation, repeat OCT, visual field analysis, and iron profile. A repeat lumbar puncture was done at 3 months in clinically indicated cases to assess CSF pressure response.Patients were

stratified into iron-deficient and non–iron-deficient groups at baseline. In the prospective subgroup, comparisons were made before and after iron therapy. The primary outcomes included change in CSF opening pressure and resolution/improvement in papilledema. Secondary outcomes assessed included symptom improvement, changes in visual parameters, and correlation with iron indices.

Results: A total of 30 patients with confirmed Idiopathic Intracranial Hypertension (IIH) were included in the study. The mean age of participants was 31.2 ± 7.8 years, with a predominant female distribution (86.7%). All patients fulfilled the Modified Dandy criteria for IIH diagnosis, and baseline evaluation included detailed clinical, hematological, neuro-imaging, and ophthalmic assessments. Iron Profile Status, among the 30 patients, 15 (50%) were iron-deficient based on low serum ferritin and transferrin saturation levels, while 15 (50%) had normal iron profiles. There was no significant difference in age, BMI, or gender distribution between the iron-deficient and non-deficient groups. However, baseline CSF opening pressure was significantly higher in the iron-deficient group ($p < 0.05$). Change in CSF Opening Pressure Paired t-test analysis was conducted to assess changes in CSF Opening Pressure (OP) from baseline to 3-month follow-up across the entire cohort. The mean baseline CSF OP was 35.44 ± 2.80 cm H_2O, which significantly reduced to 22.39 ± 2.65 cm H_2O at 3 months ($p = 0.001$). This reduction was observed across both iron-deficient and non-deficient groups; however, the magnitude of decrease was more pronounced in the iron-deficient group after iron supplementation was initiated from the second week onward. These findings are visually depicted in the graph below, highlighting a consistent downward trend in CSF OP over 3 months following standardized therapy and nutritional correction in the deficient group. Iron Supplementation Impact In the 15 iron-deficient patients, iron supplementation (oral or parenteral based on tolerance) led to significant improvements in iron indices: Serum ferritin increased from a baseline mean of 7.3 ± 2.1 ng/mL to 28.6 ± 4.2 ng/mL at 3 months ($p < 0.001$).Transferrin saturation improved from 12.4% to 25.3% ($p < 0.01$). Hemoglobin rose from 9.8 ± 1.4 g/dL to 11.6 ± 1.2 g/dL ($p < 0.01$).Additionally, a clear temporal correlation was observed between correction of iron status and: Improved visual acuity in 81% of deficient patients, Resolution of papilledema (Frisén grade improvement ≥2 in 75%),And a marked decrease in headache frequency and severity scores (VAS >5 reduced to <2 in most cases).Symptomatology and Visual Outcomes Transient visual obscurations (TVOs) were present in 66.7% at baseline; resolved in 80% of these at follow-up.Papilledema improved significantly (mean Frisén grade: 2.8 to 1.2).No patients required surgical intervention (optic nerve sheath fenestration or CSF shunting).Visual field testing showed stabilization or improvement in 93.3% of total cases.

Conclusion: This study establishes a clinically significant link between iron deficiency and IIH, demonstrating that correction of iron imbalance leads to a measurable decline in CSF opening pressure and improvement in visual and symptomatic outcomes. The data suggest that iron status is not merely a background variable but a modifiable determinant of disease severity and trajectory. Standard IIH therapies alone may be insufficient in iron-deficient individuals, and their response improves meaningfully after iron correction. These findings advocate for a paradigm shift—from treating IIH as a monolithic idiopathic entity to adopting a targeted, etiological approach. Integrating iron profile screening into routine IIH workup may enable earlier intervention and avoid invasive procedures in select patients. This reinforces the role of individualized therapy in enhancing outcomes and reducing disease burden.

Keywords: Idiopathic Intracranial Hypertension, Iron Deficiency, Cerebrospinal Fluid Pressure, Papilledema, Optical Coherence Tomography, Ferritin, Headache, Acetazolamide, Visual Function, Iron Repletion.

INTRODUCTION

Idiopathic Intracranial Hypertension (IIH), formerly referred to as pseudo-tumor cerebri or benign intracranial hypertension, is a neurological disorder characterized by elevated intracranial pressure (ICP) in the absence of any identifiable structural, neoplastic, infectious, or hydrocephalic cause.[1,2] It most commonly affects young, obese women of childbearing age, though it can also occur in men,

children, and non-obese individuals. The classic presentation includes headache, visual disturbances (especially transient visual obscurations), papilledema, and occasionally pulsatile tinnitus or sixth nerve palsy. Despite its name, IIH is not benign, as it can lead to progressive visual loss and permanent blindness if not managed effectively.[3,4] The pathophysiology of IIH remains poorly understood. Several mechanisms have been proposed, including impaired CSF absorption at the level of the arachnoid villi, increased CSF production, cerebral venous outflow obstruction, and altered hormonal influences, especially involving adipose tissue and androgens. The strongest modifiable risk factor is obesity. Studies have shown that weight gain is a significant risk factor for disease onset and progression, and weight loss is associated with symptomatic improvement and disease remission.[5,6] Other possible contributing factors include endocrine disorders, sleep apnea,[7] certain medications (e.g., tetracyclines, vitamin A derivatives), and nutritional deficiencies, particularly iron and other micronutrients.[8-10] The diagnosis of IIH is clinical but follows standardized criteria such as the Modified Dandy Criteria. These include: Signs and symptoms of raised ICP, such as headache and papilledema. Normal neurological examination, except for cranial nerve VI palsy. Normal neuroimaging (MRI or CT) with no mass lesion or hydrocephalus, though signs like an empty sella, globe flattening, and venous sinus stenosis may support the diagnosis.[5,11] Elevated CSF opening pressure (typically >25 cm H_2O in adults) on lumbar puncture, with normal CSF composition. Visual field testing and optical coherence tomography (OCT) are essential to assess the severity of papilledema and to monitor for optic nerve damage.[11,12] The primary goals in managing IIH are to preserve visual function and to relieve symptoms, particularly headaches. The choice of treatment depends on the severity of visual loss, papilledema, and patient-specific risk factors.[13,14] Weight loss is the cornerstone of treatment, particularly in overweight and obese patients. Even a 5–10% reduction in body weight has been associated with decreased ICP and resolution of papilledema. Lifestyle interventions include caloric restriction, low-sodium diet, and regular physical activity. Bariatric surgery is considered in patients who are morbidly obese or fail conservative measures.[6] Diuretics like furosemide may be used adjunctively. Corticosteroids are generally avoided due to long-term side effects, but may be used for short durations in acute visual decline.[15] Patients should be educated on the signs of worsening vision and the need for urgent reassessment. Lifelong monitoring may be necessary due to risk of recurrence, particularly with weight gain.[8,4] Recent literature suggests that iron deficiency anemia (IDA) may act as a precipitating factor in some cases of IIH. The mechanisms are still speculative, involving hyperviscosity, impaired venous drainage, and hypoxia-induced cerebral edema.[8-18] Correction of anemia has been shown in some case reports to resolve IIH symptoms, prompting a need for routine iron studies in unexplained or atypical IIH cases.[9,14,19-21] This area remains under research but may alter the diagnostic and therapeutic approach in select patients.[10,16,21,22] IIH is a complex and potentially vision-threatening disorder requiring a multidisciplinary approach to management. Treatment must be individualized, combining lifestyle modification, medical therapy, and, where necessary, surgical intervention. Given the increasing prevalence of obesity and its association with IIH, preventive strategies and early identification of at-risk individuals, including those with iron deficiency, are critical. With timely diagnosis and comprehensive care, most patients with IIH can achieve good visual and functional outcomes.[1,5,8,10]

MATERIALS AND METHODS

Place Of Study: Study was conducted in NIZAM INSTITUTE OF MEDICAL SCIENCES hospital, a tertiary care multispeciality referral hospital in South India. Subjects admitted with a provisional diagnosis of Idiopathic Intracranial Hypertension with a minimum follow up of 3 months to the department of Neurology will be included. All subjects diagnosed with Idiopathic Intracranial Hypertension will be briefed about the study and will be recruited after obtaining informed consent.

Study Design: Ambispective (prospective + retrospective) observational (cohort) study.

Study period: The present observational study will be conducted from June 2024 to June 2025

Study Sample and Size: The sample size for the study to be statistically significant is 30.

Sample size calculation: Sample size was estimated based on available literature evaluating iron deficiency in IIH patients (e.g., Meng et al., 2019; Mollan et al., 2009), where the prevalence of iron deficiency in IIH ranged from 35% to 60%. Assuming an anticipated proportion of 40% iron deficiency among IIH cases and a clinically significant reduction in CSF opening pressure post-correction, a sample size of 30 patients was determined to achieve 90% power, with a 5% Type I error and 95% confidence interval. This sample size ensures adequate power to detect significant changes in CSF pressure, visual outcomes, and hematological indices post-treatment, in line with primary endpoints of the study.

Selection criteria:

Inclusion criteria

Patients aged 15 to 55 years To include adolescent and adult populations commonly affected by IIH. Diagnosed with Idiopathic Intracranial Hypertension (IIH),As per the revised Friedman and Jacobson diagnostic criteria, which include: Elevated CSF opening pressure (≥25 cm H_2O in adults),Normal neuroimaging (MRI/MRV), Normal CSF composition, Presence of papilledema or abducens nerve palsy, No evidence of secondary causes of

raised intracranial pressure,(e.g., venous sinus thrombosis, space-occupying lesions, infections, or systemic illnesses).Consent to undergo iron profile testing Including serum iron, ferritin, transferrin saturation, TIBC, and hemoglobin levels. Willingness to participate in follow-up assessments, For evaluation of visual outcomes, symptom progression, and treatment response.

Exclusion criteria

Patients with secondary causes of raised intracranial pressure (e.g., cerebral venous sinus thrombosis, brain tumors, hydrocephalus, CNS infections, or metabolic disorders). History of chronic systemic illnesses, Such as chronic kidney disease, chronic liver disease, uncontrolled diabetes mellitus, or autoimmune disorders that can independently affect iron metabolism. Known hematological disorders, Including thalassemia, sickle cell anemia, aplastic anemia, or hemochromatosis. Current or recent (within 3 months) iron supplementation or blood transfusion, Which may alter the baseline iron profile, confounding the study results. Pregnant or lactating women, Due to physiological alterations in intracranial pressure and iron metabolism that could bias the findings. Inadequate clinical records or inability to follow up, Including those unwilling or unable to attend scheduled follow-up visits or provide informed consent.

Informed consent: All the patients fulfilling the selection criteria and their attendees will be explained about the purpose of the study and a written informed consent was obtained before enrollment.

Study methodology: This ambispective observational study was conducted at Nizam's Institute of Medical Sciences (NIMS), Hyderabad, a tertiary care neuroscience center in South India, over a period of 12 months. A total of 30 patients diagnosed with Idiopathic Intracranial Hypertension (IIH) were enrolled based on standard diagnostic criteria, including symptoms of raised intracranial pressure, presence of papilledema, and elevated CSF opening pressure with normal neuroimaging and CSF composition. Stratification and Grouping, At baseline, all patients underwent a complete hematological workup, including iron profile analysis. Based on serum ferritin and transferrin saturation values, patients were stratified into two cohorts: Iron-Deficient (ID) Group: Defined by serum ferritin <30 ng/mL and/or transferrin saturation <15%, Non-Iron-Deficient (NID) Group: All remaining patients with normal iron indices. Treatment Protocol, All patients received standard acetazolamide therapy (250–500 mg BID), initiated immediately upon diagnosis. In the ID group, oral iron therapy (elemental iron 100 mg/day, as ferrous ascorbate) was initiated two weeks after the start of acetazolamide, to reflect real-world clinical sequencing and to avoid early polytherapy confounding. No patients received corticosteroids, diuretics, or nutritional iron fortification during the study period.

Follow-Up Design: Patients were followed longitudinally at three defined timepoints, Baseline (0 weeks) – before starting any treatment. 1 Month – after acetazolamide but before iron correction effect manifests.[3] Months – post-completion of iron therapy and acetazolamide continuation. At each visit, the following were assessed systematically: CSF Opening Pressure (baseline and at 3 months via lumbar puncture), Visual Acuity (Snellen chart), Papilledema (Frisen grading on fundus exam), RNFL Thickness (via Optical Coherence Tomography), Headache Severity (Visual Analog Scale).

Outcome Analysis and Rationale- The study focused on evaluating the delta (change) from baseline to 3 months for all outcome variables in both ID and NID groups. Statistical methods included: Paired t-tests to assess within-group changes over time, Unpaired t-tests to compare between-group differences, Correlation coefficients (Pearson) to explore the relationship between serum ferritin levels and improvements in RNFL thickness and CSF pressure. All analyses were conducted using SPSS v25. A p-value < 0.05 was considered statistically significant stabilization and visual prognosis.

Statistical analysis: All statistical analyses were performed using GraphPad Prism version 9.0. Descriptive data were expressed as mean ± standard deviation (SD) for continuous variables and as frequencies with percentages for categorical variables. Comparative analyses between the Iron-Deficient (ID) and Non-Iron-Deficient (NID) groups were carried out using the following methods: Unpaired t-tests were applied for comparing independent continuous variables between groups (e.g., baseline CSF opening pressure, hemoglobin levels).Paired t-tests were employed to assess intra-group differences in continuous variables before and after treatment (e.g., delta CSF opening pressure, RNFL thickness).Chi-square test or Fisher's exact test was used for analyzing categorical variables such as gender distribution and the presence or absence of papilledema. Pearson correlation analysis was used to evaluate associations between iron indices and CSF opening pressure or RNFL thickness. P-values < 0.05 were considered statistically significant. All analyses adhered to a two-tailed hypothesis testing framework, and 95% confidence intervals (CI) were reported where appropriate.

RESULTS

This table compares baseline clinical and laboratory parameters between iron-deficient (ID) and non-iron-deficient (NON-ID) IIH patients. While age, BMI, headache severity (VAS), RNFL thickness, and CSF opening pressure showed no significant difference between the groups, baseline serum ferritin was significantly lower in the ID group (14.1 ± 6.4 ng/mL vs 112.15 ± 26.89 ng/mL, $p = 0.001$). This highlights a strong association between iron deficiency and IIH,

supporting its potential role in disease pathophysiology.

Table 1: Comparison of Baseline Demographic, Clinical, and Laboratory Parameters between Iron Deficient (ID) and Non-Iron Deficient (NON-ID) IIH Patients

	ID (n=15)		NON-ID (n=15)		P value
	Mean	SD	Mean	SD	
Age	32.07	10.640	34.13	10.501	0.597
BMI	27.347	1.8999	27.727	1.6047	0.559
Headache VAS BL	7.447	.8535	7.787	.6749	0.236
RNFL RE BL	205.07	14.670	204.93	15.732	0.981
RNFL LE BL	211.00	14.358	207.20	14.249	0.473
CSF OP BL	35.440	2.8084	35.247	3.0043	0.857
Ferritin BL	14.100	6.4065	112.153	26.8893	0.001



Figure 1: Comparison of Baseline Demographic, Clinical, and Laboratory Parameters between Iron Deficient (ID) and Non-Iron Deficient (NON-ID) IIH Patient



Figure 2: Comparison of Retinal Nerve Fiber Layer (RNFL) Thickness and Serum Ferritin Levels between Iron Deficient and Non-Iron Deficient IIH Patients at Baseline

Table 2: Distribution of Frisen Papilledema Grades (Right Eye) at Baseline between Iron Deficient and Non-Iron Deficient IIH Patients

			Group		Total
			NON-ID	ID	
Frisen RE BL	2	Count	4	6	10
		%	26.7%	40.0%	33.3%
	3	Count	10	6	16
		%	66.7%	40.0%	53.3%
	4	Count	1	3	4
		%	6.7%	20.0%	13.3%
Total		Count	15	15	30
		%	100.0%	100.0%	100.0%

Chi square = 2.400, P value = 0.301 (NS)

This chart illustrates the comparison of RNFL thickness (both right and left eye) and serum ferritin levels between iron-deficient (ID) and non-iron-deficient (NON-ID) IIH patients at baseline. While RNFL values were similar across both groups, ferritin levels were markedly lower in the ID group (14.1 ng/mL vs 112.15 ng/mL). This visually reinforces the statistically significant association between iron deficiency and IIH (p = 0.001). The RNFL thickness did not show significant intergroup variation.

Table 3: Distribution of Frisen Papilledema Grades (Left Eye) at Baseline between Iron Deficient and Non-Iron Deficient IIH Patients

			Group		Total
			NON-ID	ID	
Frisen LE BL	2	Count	4	6	10
		%	26.7%	40.0%	33.3%
	3	Count	10	6	16
		%	66.7%	40.0%	53.3%
	4	Count	1	3	4
		%	6.7%	20.0%	13.3%
Total		Count	15	15	30
		%	100.0%	100.0%	100.0%

Chi square = 2.400, P value = 0.301 (NS)

No statistically significant difference was observed in baseline Frisen papilledema grades between the iron-deficient and non-deficient groups (P = 0.301). Most patients in both groups had Grade 3 papilledema. Grades 4 papilledema were slightly more frequent in the ID group (20% vs 6.7%), but not significant. The distribution pattern was similar in both right and left eyes.

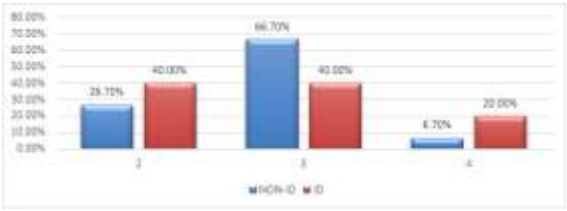


Figure 3: Distribution of Frisen Papilledema Grades (Right and Left Eye) at Baseline between Iron Deficient and Non-Iron Deficient IIH Patients

Table 4: Paired t-Test Analysis Comparing Baseline and 1-Month Values among Iron-Deficient IIH Patients (n = 15)

	BASELINE		AT 1 MONTH		P value
	Mean	SD	Mean	SD	
Headache VAS	7.447	.8535	6.020	.9858	0.001
RNFL RE	205.07	14.670	189.87	15.487	0.001
RNFL LE	211.00	14.358	196.47	14.167	0.001
Ferritin	14.100	6.4065	29.373	7.3866	0.001

Among iron-deficient IIH patients, there was a statistically significant improvement in headache severity (VAS), RNFL thickness in both eyes, and serum ferritin levels after 1 month. This suggests that iron deficiency correction may contribute to both clinical and radiological improvement in IIH. All changes were significant with P = 0.001.

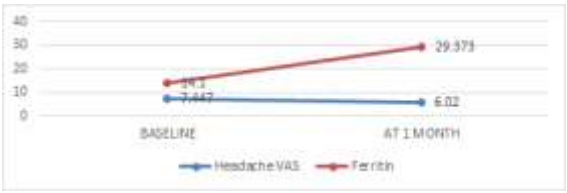


Figure 4: Change in Headache Severity and Serum Ferritin Levels from Baseline to 1 Month in Iron Deficient IIH Patients

This line graph illustrates the improvement in headache severity and serum ferritin levels over one month in iron-deficient IIH patients. Headache VAS scores significantly declined from 7.45 to 6.02, while ferritin levels nearly doubled from 14.1 ng/mL to 29.37 ng/mL. Both trends were statistically significant (P = 0.001), supporting the therapeutic benefit of addressing iron deficiency.

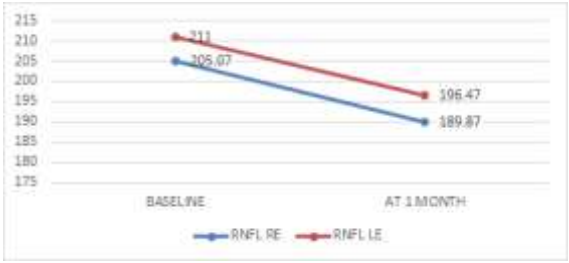


Figure 5: Reduction in Retinal Nerve Fiber Layer (RNFL) Thickness from Baseline to 1 Month in Iron-Deficient IIH Patients

This line graph shows a statistically significant decrease in RNFL thickness in both eyes from baseline to 1 month in the iron-deficient IIH group. RNFL RE reduced from 205.07 µm to 189.87 µm, and RNFL LE from 211 µm to 196.47 µm. This reflects objective improvement in optic disc swelling. The change was significant (P = 0.001 for both).

Table 5: Comparison of Clinical, Visual, and Biochemical Parameters at 1 and 3 Months among Iron Deficient IIH Patients

	AT 1 MONTH		AT 3 MONTHS		P value
	Mean	SD	Mean	SD	
Headache VAS	6.020	.9858	3.9733	.87869	0.001
RNFL RE	189.87	15.487	154.40	16.400	0.001
RNFL LE	196.47	14.167	159.53	15.779	0.001
Ferritin	29.373	7.3866	61.7267	8.18216	0.001

Among iron-deficient IIH patients, there was a statistically significant improvement from 1 to 3 months in all measured parameters. Headache VAS scores continued to decrease (6.02 → 3.97), RNFL thickness reduced further, and serum ferritin levels nearly doubled (29.37 → 61.73 ng/mL). These findings indicate sustained clinical, visual, and hematological improvement following treatment. All changes were statistically significant (P = 0.001).

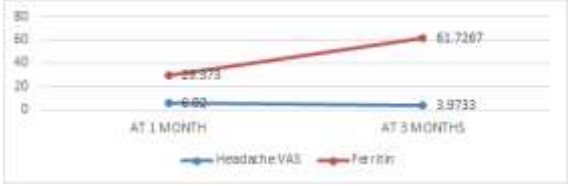


Figure 6: Trends in Headache Severity and Serum Ferritin Levels between 1 and 3 Months in Iron Deficient IIH Patients

This line graph demonstrates a continued improvement in headache severity and serum ferritin

levels from 1 to 3 months in the iron-deficient IIH group. Headache VAS scores declined from 6.02 to 3.97, while ferritin levels increased from 29.37 ng/mL to 61.73 ng/mL. Both trends were statistically significant (P = 0.001), indicating sustained clinical and biochemical recovery.



Figure 7: Distribution of Frisen Papilledema Grades at Baseline and 1 Month of Iron Deficient IIH Patients (n = 15)

This bar chart shows a marked improvement in Frisen grades among iron-deficient IIH patients from baseline to 1 month. Grade 4 papilledema was eliminated, and Grade 1 increased to 33.3%, indicating resolution of optic disc edema. The trend demonstrates statistically and clinically significant structural recovery.

Table 6: Comparison of Changes in Clinical, Radiological, and Biochemical Parameters between Iron Deficient and Non-Iron Deficient IIH Patients

	ID (n=15)		NON-ID (n=15)		P value
	Mean	SD	Mean	SD	
Δ CSF OP	13.047	1.5697	11.013	3.0754	0.030
Δ Headache VAS	3.4733	.28652	2.5000	.34226	0.001
Δ Ferritin	47.6267	5.65211	7.3200	1.02692	0.001
Δ RNFL RE	50.67	6.914	49.13	6.621	0.540
Δ RNFL LE	51.47	6.875	50.40	6.379	0.663

This table compares the magnitude of change in key parameters between ID and NON-ID IIH patients over time. The ID group showed significantly greater improvement in headache severity, CSF opening pressure, and serum ferritin levels (P < 0.05). Changes in RNFL thickness were similar in both groups and not statistically significant. These findings support a beneficial role of iron correction in IIH outcomes.

This bar chart compares the mean reduction in CSF opening pressure and headache severity between iron-deficient and non-deficient IIH patients. The ID group demonstrated a greater reduction in both CSF pressure (13.05 vs 11.01 cm H_2O) and headache VAS score (3.47 vs 2.5). Both differences were statistically significant (P < 0.05), supporting the beneficial role of iron correction.

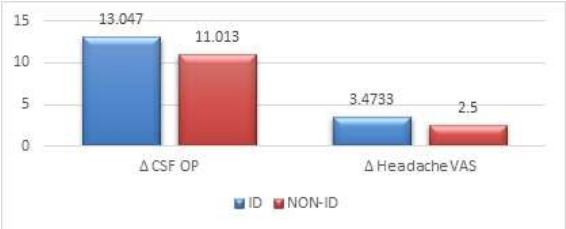


Figure 8: Comparison of Mean Changes in CSF Opening Pressure and Headache Severity between Iron Deficient and Non-Iron Deficient IIH Patients.

Table 7: Correlation of Change in Serum Ferritin with Clinical and Neuro-ophthalmological Parameters

		Δ CSF OP	Δ Headache VAS	Δ RNFL RE	Δ RNFL LE
Δ Ferritin	Pearson Correlation	.380	.812	.118	.162
	P VALUE	.038	.001	.536	.392
	N	30	30	30	30

A statistically significant positive correlation was observed between change in ferritin and reduction in CSF opening pressure (r = 0.38, p = 0.038) and headache VAS scores (r = 0.812, p = 0.001). No significant correlation was found between ferritin change and RNFL thickness in either eye. This suggests improvement in intracranial pressure and headache severity with correction of iron deficiency.



Figure 9: Correlation between Change in Serum Ferritin and Change in CSF Opening Pressure



Figure 10: Correlation between Change in Serum Ferritin and Change in Headache VAS Score



Figure 11: Temporal Trends in Frisen Grade (Left Eye) Over Baseline to 3-Month Follow-up in IIH Patients

DISCUSSION

Idiopathic Intracranial Hypertension (IIH) is defined by raised intracranial pressure in the absence of an overt structural lesion, hydrocephalus, infection, or malignancy. It predominantly affects obese women of reproductive age, with an incidence that increases significantly in this demographic (Durcan et al., 1988; Daniels et al., 2007). The clinical spectrum commonly includes headache, transient visual obscurations, pulsatile tinnitus, diplopia due to sixth nerve palsy, and papilledema leading to progressive visual loss (Wall, 2010; Acheson, 2006). Traditionally considered idiopathic, IIH is increasingly being examined for underlying systemic and metabolic contributors. Among these, iron deficiency has emerged as a potential modifiable factor, with several case reports and small series describing improvement in symptoms following iron correction (Tugal et al., 1994; Mollan et al., 2009; Capriles, 1963; Forman et al., 2013). Iron deficiency is known to alter oxygen delivery and cerebrovascular autoregulation and has been implicated in increasing cerebral venous pressure through mechanisms like cerebral venous sinus thrombosis, particularly in severe deficiency states (Kinoshita et al., 2006; Ogata et al., 2008; Balci et al., 2006). Collectively, these findings establish a consistent and biologically plausible link between iron status correction and accelerated resolution of optic disc edema in IIH. By integrating functional (Frisen) and structural (RNFL) parameters, this study provides multidimensional evidence of therapeutic impact, reinforcing the emerging paradigm of micronutrient-augmented management in neuro-ophthalmic disorders.

CONCLUSION

Early identification and timely correction of iron deficiency not only improves hematological parameters but also enhances neurological and ophthalmological outcomes, potentially reducing disease burden and avoiding unnecessary invasive procedures. Further large-scale studies are warranted to validate these findings and to establish standardized iron repletion protocols in IIH management algorithms.

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