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ORIGINAL ARTICLE

The Role of Optical Coherence Tomography of the Optic Nerve Head in Follow up of Operated Idiopathic Intracranial Hypertension

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ABSTRACT

Background: When diagnosing papilledema caused by idiopathic intracranial hypertension, a fast and non-invasive method is optical coherence tomography (OCT). This work aimed to determine the OCT's ability to predict for optic disc edema follow-up in patients undergoing cerebrospinal fluid (CSF) diversion procedures for patients who have idiopathic intracranial hypertension.

Methods: This cross-sectional study included 36 participants with 72 scanned eyes for operated cases of idiopathic intracranial hypertension who were presented to the ophthalmology outpatient clinic of Zagazig University Hospitals for follow up. Optic nerve head examination and scanning was done using Spectral domain OCT.

Results: The results demonstrated a statistically significant difference between the papilledema Frisen scale and the ICP ($p=0.002$), with a higher mean ICP value (37.7±5.27) observed in eyes with a grade of 5. The disc elevation mean value was 1131.1±91.48, which was highest in eyes with grade 5, indicating a statistically significant difference between the papilledema Frisen scale and disc elevation ($p<0.001$). A statically significant difference between papilledema Frisen scale and disc elevation at the 2nd reading after revision of shunt ($p<0.05$) as eyes with grade 5 showed higher 2nd reading after revision of shunt ($p<0.001$).

Conclusions: Serial OCT examinations can detect subtle changes in optic nerve morphology that may not be detected by clinical examination alone. This early detection of structural abnormalities enables prompt intervention and optimization of treatment strategies, potentially preventing further vision loss.

Keywords: Optic Nerve Head; Idiopathic Intracranial Hypertension; Optical Coherence Tomography.

INTRODUCTION

Idiopathic intracranial hypertension (IIH) is a disorder of unknown etiology characterized by chronically elevated intracranial pressure (ICP), and the most important neurologic manifestation is papilledema. The persistent headaches and vision impairment are symptoms that identify the condition [1]. A normal brain magnetic resonance imaging (MRI), Prescence of papilledema, as well as a normal composition of cerebrospinal fluid are considered the diagnostic criteria. [2].

Because optic atrophy, a long-term complication of papilledema, can cause permanent vision loss, a correct diagnosis of idiopathic intracranial hypertension is crucial [3]. Swelling of the axonal optic nerve head (ONH) due to elevated perineural pressure is known as papilledema in idiopathic intracranial hypertension [4]. Lumbar puncture is the gold standard for measuring intracranial pressure, but it's a risky procedure that patients often find upset with negative experience. [5].

CSF diversion procedures are used in refractory cases not responding to conservative treatment [6]. Follow up of cases had CSF diversion procedures is necessary because many complications as shunt obstruction, catheter malposition, over drainage and valve malfunction may occur [7]. Assessing the functionality of shunts is done by fundus examination to detect papilledema, CT abdomen and CT brain.

Fundoscopy is a clinical tool for evaluating papilledema. The degree of papilledema is determined by observing the disc margin, height, and the visibility of the vessels. While the Frisen scale has helped to standardize papilledema grading, examiners' levels of knowledge and experience still play a role in the subjective clinical evaluation of papilledema severity [8].

The high expense of the examination and the dangers of ionizing radiation exposure are two main concerns regarding CT scans. It has been stressed that there is a need for safer, more sensitive ways to track treatment response and long-term visual prognosis in people with idiopathic intracranial hypertension [9].

One non-invasive technique that can produce high-resolution cross-sectional imaging of the ONH and retina is optical coherence tomography (OCT). In the field of ophthalmology, it has emerged as a crucial tool [10].

OCT parameters of ONH such as retinal nerve fiber layer thickness (RNFL), disc elevation and optic cup volume are very useful in assessment papilledema of idiopathic intracranial hypertension [11]. So, this work aims to determine the OCT's ability to predict optic disc edema follow-up in patients undergoing cerebrospinal fluid diversion procedures for patients who have idiopathic intracranial hypertension.

METHODS

This cross-sectional study included 36 participants with 72 scanned eyes for operated cases of idiopathic intracranial hypertension who presented to the ophthalmology outpatient clinic of Zagazig University Hospitals for follow up during the period from January 2024 to August 2024. Consent was collected from all patients. The approval for the study was obtained from Zagazig University Hospitals from the Institutional Review Board (#10928) and the research was conducted in accordance with the Helsinki Declaration

The enrolled cases were those who were operated of idiopathic intracranial hypertension and presented to the ophthalmology outpatient clinic of Zagazig University Hospitals for follow up (18 to 60 years old).

Cases with the following characteristics were excluded; age of patients <18 years or >60 years, patients who had other optic disc pathology (congenital anomalies or glaucoma), cases who had ocular media opacity affecting OCT parameters significantly, Patients who could not accommodate the capture position of OCT as patients with cervical spine disorders or bedridden patients.

Ophthalmic examination:

A full history was taken from all included individuals including age, complaint, history of ocular trauma or disease and any systemic medical diseases.

The best corrected visual acuity (BCVA): Following refraction, the BCVA was calculated by recording its decimal equivalent of Landolt's broken ring chart.

Slit-lamp bio microscopy: Applanation tonometry was used to measure intraocular pressure, the cornea was checked for signs of scarring and swelling, and the anterior chamber was assessed for regularity, depth, aqueous flare, and cells.

Fundus examination: Using auxiliary lenses (with a magnification of +78 D) to look into the optic disc and the mid-peripheral retina in order to rule out potential pathology (such as cystoid macular edema or macular scarring).

Fundus photography:

Imaging the optic disc and grading the papilledema using the Kowa fundus camera and the Modified Frisen Scale:

Stage 0**;** (Optic disc to be normal): Inversely proportional to diameter, the retinal nerve fiber layer is most prominent at the nasal, superior, and inferior poles. Lack of tortuosity in the radial nerve fiber layer. Stage 1; (Papilledema of minimal degree): Subtle, grayish, C-shaped halo with a temporal gap; masks retinal features below. The striations that normally arrange the radial nerve fiber layers are disrupted. Standard margin of the temporal disc. Stage 2; (Papilledema of mild degree): There is no significant occlusion of main vessels, an elevated nasal border, and a circumferential halo. Stage 3**;** (Papilledema of moderate degree): Circumferential halo, elevation of all disc boundaries, and obliteration of a portion of main

blood arteries leaving the disc. Stage 4**;** (Papilledema of marked degree): Complete nerve head elevation, border occlusion, and disc occlusion affecting a section of a large blood blood vessel**.** Stage 5**;** (Papilledema of severe degree): abnormal peri-papillary retinal arteries, optic disc cup obliteration, and dome-shaped projections indicating optic nerve head anterior expansion**.**

Optical Coherence Tomography (OCT) Examination:

Spectral domain optical coherence tomography (RS-3000, OCT Retina Scan, NIDEK CO. Ltd, Japan) was used for the evaluation and scanning of the optic nerve head. With a speed of 53,000 A-scans per second, an optical resolution of 7 µm on the z-axis, and 20 µm on the x and y axes, this device's light source operates at a wavelength of 880 nm.Following pupil dilation, SD-OCT measurements were taken. We repeated the scans that had a signal strength index below 7 out of 10. The Nidek RS-3000 Advance system's tracing HD plus function minimizes blink and motion artifacts.

A disc map focused on the optic disc of 3.4 mm in diameter was used to determine the peripapillary RNFL thickness. The four quadrants of the RNFL were assessed for thickness: nasal, inferior, superior, and temporal. In order to get the average thickness, the proprietary algorithm estimates the overall retinal thickness and the inner and outer borders of the RNFL using a best-fitting technique. To quantify the degree of optic disc elevation, a radial 6 mm scan was utilized, which consisted of 6 scans..

Using calipers at the inferior and superior corners of the optic disc, as well as the temporal and nasal edges, the disc elevation was measured manually from the internal limiting membrane to the inner boundary of retinal pigment epithelium (RPE). A 6 mm radial disc map was used for qualitative evaluation of the disc and its swelling shape. It can assess the optic disc's shape, identify drusen, and determine whether or not sub-retinal fluid is present along the disc's edges.

Main Outcome Measures:

Measurements of RNFL thickness in all four quadrants, measurements of disc elevation in superior, inferior, temporal, and nasal parts, and qualitative data of optic nerve head (ONH) imaging were collected.

Statistical Analysis:

We used SPSS 26.0 for Windows (SPSS Inc., Chicago, IL, USA) to gather, tabulate, and analyze all of the data. The mean plus or minus the standard deviation and the median were used to represent quantitative data, while the number of occurrences and the percentage of occurrences were used to represent qualitative data. When comparing more than two groups of regularly distributed variables, the one-way ANOVA test was utilized, and when comparing more than two groups of non-normally distributed variables, the Kruskall-Wallis test was employed. The association between the several study variables was evaluated using the person correlation coefficient. A number close to 1 indicates strong correlation, while a value near 0 indicates weak correlation. A positive sign indicates direct correlation and a negative sign indicates inverse correlation. There was no one-sided test. Statistical significance (S) was denoted by a p-value less than 0.05, and statistical insignificance (NS) by a p-value greater than or equal to 0.05.

RESULTS

A total of 36 participants with 72 scanned eyes included and the mean age of them was 32.8±10.54 years with range (18 to 58 years) more than half of them 72.2% were females and the other 27.8% were males, the mean Intracranial pressure was 31.03±7.37 ranging from 14 to 45 mmHg, Regarding Frisén grades, about (41.7%) of eyes were grade 3, one third of them (31.9%) were grade 4, ten eyes (13.9%) showed grade 5 and (11.1%) of eyes were normal (Table 1).

We found that the mean Best Corrected Visual Acuity (BCVA) was 0.82±0.88 with median 0.7 (0.6-0.9) IQR, the mean disc elevation was 831.16±185.22 ranging from 457 to 1360. The mean 2nd reading after revision of shunt was 731.28±139.18. papilledema Frisen scale showed that most of cases (87.5%) were abnormal and the OCT results revealed the same percentage (Table 2).

The results demonstrated a statistically significant difference between the papilledema Frisen scale and the ICP (p=0.002), with a higher mean ICP value (37.7±5.27) observed in eyes with a grade of 5. The disc elevation mean value was 1131.1±91.48, which was highest in eyes with grade 5, indicating a statistically significant difference between the papilledema Frisen scale and disc elevation (p<0.001) (Table 3).

A statically significant difference between papilledema Frisen scale and disc elevation at the 2nd reading after revision of shunt ($p<0.05$) as eyes with grade 5 showed higher 2nd reading after revision of shunt ($p<0.001$) (Table 4).

Regarding spearman's correlations, there was significant positive correlation ($p<0.001$) between disc elevation and the 2nd reading after revision of shunt (Table 5).

Table 1: Basic characteristics, Intracranial Pressure and Frisén grades of the studied group

Variables		**Studied group**	
Age mean±SDRange		32.8±10.54 (18-58)	
Sex	**Female**	N	**%**
		26	72.2
	Male	10	27.8
Variables		**Studied group**	
ICP mean±SDRange		31.03±7.37 (14-45)	
		N	**%**
Frisén grades	**Normal**	8	11.1
	Grade 2	1	1.4
	Grade 3	30	41.7
	Grade 4	23	31.9
	Grade 5	10	13.9

ICP: Intra cranial pressure

Table 2: Optical coherence tomography (OCT) and Frisen scale of the studied group

Variables		**Studied group**	
BCVA mean±SD median (IQR)		0.82±0.88 0.7 (0.6-0.9)	
Disc elevation by OCT mean±SDRange		831.16±185.22 (457-1360)	
Reading 2 after revision of shunt By OCT mean±SDRange		731.28±139.18 (544-1019)	
Variables		**Studied group**	
		N	**%**
Frisen scale	Normal	8	11.1
	Abnormal	64	87.5
OCT results	Normal	8	11.1
	Abnormal	64	87.5

BCVA: Best corrected visual acuity, OCT: Optical coherence tomography

Table 3: Relation between Frisén grades and ICP, BCVA and Disc Elevation

Variables	Frisén grades				Test	P value
	Grade 2 (n=1)	Grade 3(n=30)	Grade 4(n=23)	Grade 5(n=10)		
ICP Mean±SDRange	35	33.11±5.12 (25-45)	30.83±3.11 (27-40)	37.7±5.27 (30-45)	5.507 ***(f)***	**0.002 ***
BCVA mean±SD median (IQR)	0.5	0.69±0.21 0.7 (0.5-0.9)	0.78±0.2 0.8 (0.6-1)	1.37±2.34 0.75 (0.5-0.8)	3.846 ***(k)***	0.279
Disc elevation mean±SD Range	457	693.53±79.21 (542-884)	896.52±94.82 (789-1065)	1131.1±91.48 (1026-1360)	74.981 ***(f)***	**<0.001***

ICP: Intracranial pressure, BCVA: Best corrected visual acuity
(f) one way ANOVA, *(k)* Kruskal-Wallis Test

Table 4: Relation between Frisén grades and disc elevation 2nd reading after revision of shunt

Variables	Frisén grades			Test	P value
	Grade 3 (n=10)	Grade 4(n=4)	Grade 5(n=4)		
2nd reading afterrevision of shuntmean±SD Range	646.4±84.81 (544-772)	750.5±85.92 (679-853)	924.25±81.53 (844-1019)	15.620 ***(f)***	**<0.001***

(f) one way ANOVA

Table 5: Correlation between disc elevation and differentparameters

Variables		Disc Elevation
ICP	r	-0.058
	p	0.656
reading 2 after revision of shunt	r	**.814**
	p	**<0.001***
BCVA	r	-0.040
	p	0.755
Age	r	-0.254
	p	0.161

ICP: Intracranial pressure, BCVA: Best corrected visual acuity
P= Sig. (2-tailed), r= Correlation Coefficient

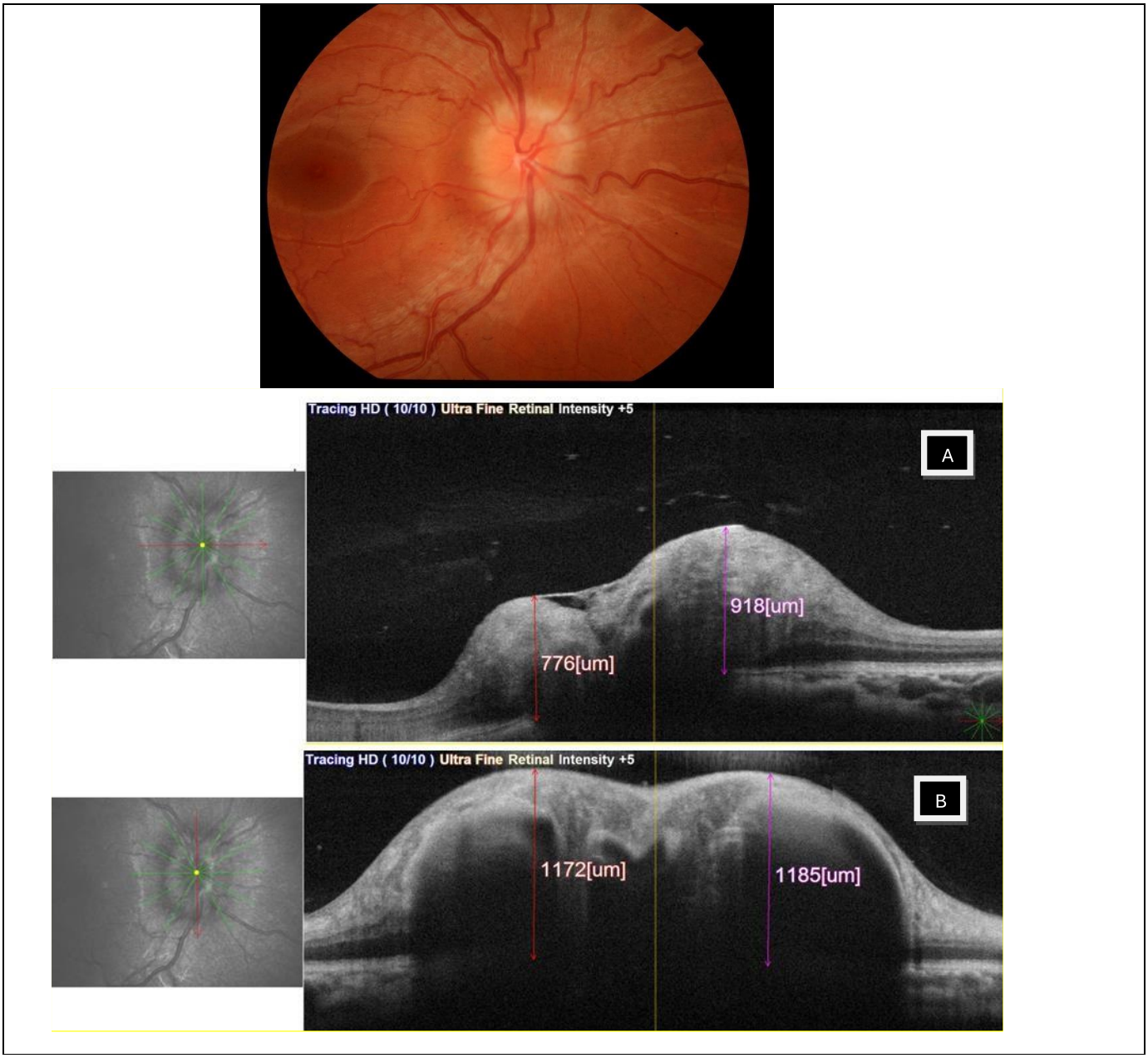
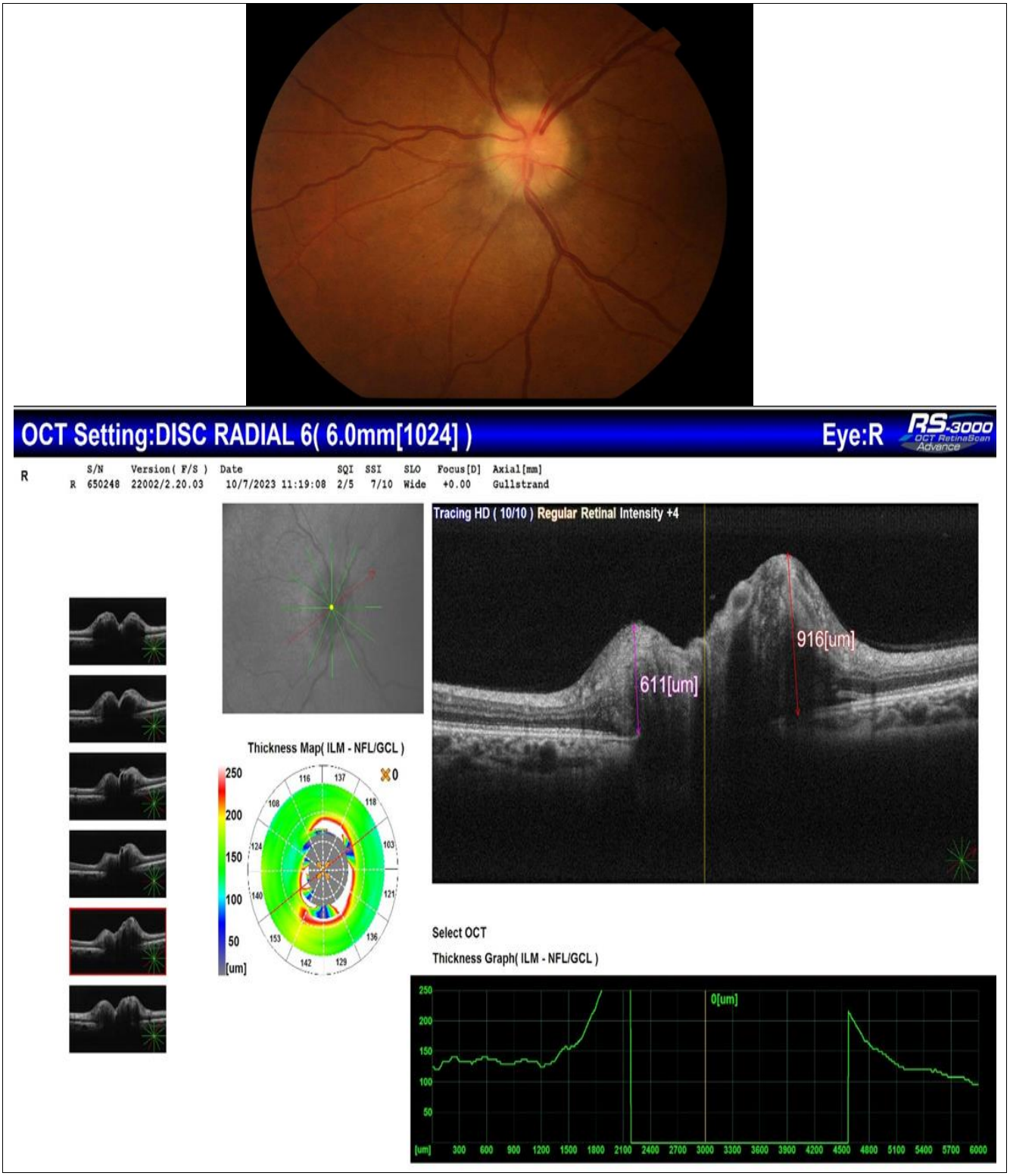


Figure 1 : Disc elevation in papilledema. A) Horizontal edge. B) Vertical edge



Figures 2: disc radial and disc map in Rt eye of moderate papilledema shows increase RNFL thickness and elevation of disc.

DISCUSSION

Elevated ICP without space-occupying lesions or other recognized cause is termed as idiopathic intracranial hypertension (IIH) [12]. Optic nerve atrophy, the end consequence of persistent papilledema, can lead to irreversible blindness. The severity of papilledema and visual loss can be used as a basis for therapeutic action, but there is currently no effective way to monitor the development of papilledema. Unfortunately, current methods are generally not objective or sensitive enough [13].

By utilizing infrared light, optical coherence tomography may produce in vivo pictures of the macula and optic nerve head with near-histological resolution; the procedure is simple, fast, and non-invasive. Optical coherence tomography shows promise as a method for monitoring the efficacy of therapeutic treatments and for measuring the progression of papilledema. In both freshly diagnosed and long-term cases of IIH, optical coherence tomography has allowed for the detection of RNFL abnormalities. Acute recurrence patients and those with freshly diagnosed IIH also had RNFL thickness above normal, whereas chronic IIH patients and those whose IIH had been treated had much thinner RNFLs. Total retinal-optic nerve volume and papillary RNFL thickness are correlated with the degree of ONH swelling. [14].

In the present study we found that the mean age of studied cases was 32.8±10.54 years ranging from 18 to 58 years and more than half of them 72.2% were females and the other 27.8% were males.

These results were compatible with Lasheen et al. [15] who reported that (85%) of studied cases were females and (15%) were males. Their median age was 31 years and ranged from 20 to 56 years with mean ± SD of 36.08 ± 12.47 years. Dreesbach et al. [14] showed Overall, 95% of the patients with intracranial hypertension were female, and their mean age was 30 ± 11 years. They further mentioned that the average age of patients with IIH was 30 ± 11 years, and that women made up 95% of these patients.

In the current study we found that the mean intracranial pressure was 31.03±7.37 ranging from 14 to 45 mmHg. Regarding Frisén grades, about (41.7%) of eyes were grade 3, one third of them (31.9%) were grade 4, ten eyes (13.9%) showed grade 5 and (11.1%) of eyes were normal.

The current study results were supported by a study of Lasheen et al. [15], as they showed that the papilledema was distributed according to modified Frisen scale into 10 (25%) patients with stage 1, 22 (55%) with stage 2, four (10%) with stage 3, and four (10%) with stage 4. The papilledema was distributed according to OCT into 10 (25%) patients with stage 1, 26 (65%) with stage 2, and four (10%) with stage 3.

This was in accordance with Scott et al. [16] who found that, following the majority rule, of 36 individuals with papilledema, seven (19%) had grade 0, seven (19%) had grade 1, 10 (28%) had grade 2, four (11%) had grade 3, and eight (22%) had grade 4 e disc edema. However, in the study of Mohamed et al. [17] revealed that seven (21%) had stage 1, 10 (30%) had stage 2, four (12%) had stage 3, and nine (27%) had stage 4. They noticed a significant association between the MFS and OCT results.

The current study findings regarding OCT clearly revealed that the mean Best Corrected Visual Acuity (BCVA) was 0.82±0.88 with median 0.7 (0.6-0.9) IQR, the mean disc elevation was 831.16±185.22 ranging from 457 to 1360. The mean 2nd reading after revision of shunt was 731.28±139.18.

In alignment with our findings, Lasheen et al. [15] showed that the median RNFL thickness was 108.5 and ranged from 84 to 152 with mean ± SD of 112.04 ± 19.79, whereas the median best-corrected visual acuity was 0.80 and ranged from 0.50 to 1.00 with mean ± SD of 0.78 ± 0.16. Khalil et al. [18] reported that although the initial average thickness of the nerve fiber layer of the retina was collectively much higher than that of healthy individuals, it was greater than average databases in 40% of cases, near average in 32% of cases, and less than normal in 28% of the cases. Albrecht et al. [11] reported that our IIH patients had an average corrected visual acuity of 0.81 ± 1.65. At the outset, patients with IIH had worse visual acuity than controls. Visual acuity was shown to be highly related to the ONH volume at baseline, and patients' results varied greatly, spanning from 0.1 to 1.2 decimals. Even though the difference did not reach statistical significance, the mean visual acuity was poorer at follow-up.

In the present study we found that papilledema Frisen scale showed that most cases (87.5%) were abnormal, and the OCT results revealed the same percentage.

Similar findings were obtained by Lasheen et al. [15] who demonstrated that there was a strong positive marked significant association between

grades of papilledema by OCT and grades of papilledema by modified Frisen scale. Mohamed et al. [17] noticed a significant association between the MFS and OCT results. According to the study by Scott et al. [16], a significant association between the MFS and OCT findings was found.

In the current study we found that there was statistically significant difference when comparing papilledema Frisen scale and the ICP as eyes with grade 5 showed higher mean ICP value. On the other hand, there was no statistically significant difference when comparing papilledema Frisen scale and BCVA.

In agreement with our findings, Khalil et al. [18] stated that intra cranial pressure (ICP) measurements and papilledema stage were shown to be strongly associated. Auinger et al. [19] illustrated that in the Idiopathic Intracranial Hypertension Treatment Trial [IIH TT] by, both Frisén grades and ICP levels were strongly linked with the OCT variables of RNFL, total retinal content, and ONH volume; however, the association was better with Frisén grades than with LP opening pressures. Dreesbach et al. [14] shown a weak but statistically significant relationship between ONHV and intracranial pressure in our IIH patients. When comparing IIH patients to controls, Albrecht et al. [11] made it evident that the ONH volume was higher in the former group. There may be clinical significance of the measure because IIH patients' decreased visual acuity was linked to higher ONH volume.

Kaufhold et al. [20] established a negative correlation between ONH maximal height and intracranial pressure (ICP): individuals with IIH who had greater ICP display less prominent ONH height compared to those with lower ICP. According to these findings, the ONH swelling process is more common at a flat base than at a height, suggesting that ONHV is the more relevant metric for quantifying ONH. Furthermore, the ONHH evaluating algorithm also detects the rim, which could impact the investigative power of the method, even if the presence of a wall at the optic disc's periphery is not pathogenic in healthy controls. Another possible explanation for this inverse connection is that the RNFL is damaged during high-pressure phases. Several of our patients exhibited diminished RNFL, lending credence to the notion that papilledema and elevated intracranial pressure cause RNFL impairment. It is important to use caution when interpreting this finding, nevertheless, because of the sometimes-long gap between ICP and OCT observations.

Disc elevation was shown to be significantly different from the papilledema Frisen scale in this study. The highest mean value for disc elevation was observed in eyes with a grade of 5, suggesting a statistically significant difference.

The current study findings were supported by Dreesbach et al. [14] who revealed that OCT measurements of the optic nerve head volume (ONHV) and Frisén grading revealed a strong positive correlation. With the exception of grades 4 and 5, the results demonstrated statistically significant variations in ONHV across all grade levels. The estimated volume threshold for discriminating between grades 0 and 1 was 0.59 mm^3, while 1,40 mm^3 between grades 1 and 2, as well as 1.26 mm^3 between grades 2 and 3, 2.14 mm^3 between grades 3 and 4, and finally 0.66 mm^3 between grades 4 and 5.

Waisbourd et al. [21] validated the categorization of IIH patients into three groups based on the clinical appearance of the optic disc. Each of the three groups—normal optic disc/mild elevation, mild elevation, and papilledema—had significantly different average retinal nerve fiber layer (RNFL) thickness. For the majority of the macular areas assessed, the fast macular thickness map did not show a statistically significant difference between the groups.

Additionally, the results of IIH treatment are associated with RNFL OCT imaging. Skau et al. [22] and Rebolleda et al. [23] found that when RNFL thickness decreases after therapy, visual field mean deviation improves as well. Because progressive optic atrophy due to RGC injury might produce a similar OCT signal, caution is required when attributing RNFL reduction with time to resolving papilledema. The concordant decrease in RNFL thickness and macular GCL IPL thickness, according to Chen et al. [24], shows optic nerve injury and might be a sign that a treatment has failed. Additionally, RNFL thickness OCT imaging is more sensitive than clinical findings.

The current findings clearly revealed a statistically significant difference when comparing between papilledema Frisen scale and disc elevation the 2nd reading after revision of shunt as eyes with grade 5 showed higher 2nd reading after revision of shunt. There was significant positive correlation between disc elevation and the 2nd reading after revision of shunt.

These results were compatible with Hamed et al. [25] who reported that regarding fundus examination at follow up among the papilledema patients, there is a significant decrease in papilledema severity after treatment. OCT follow up showed significant decrease in intracranial pressure associated with a decrease in retinal nerve fiber layer thickness and ONH thickness. A higher ONHV was seen in patients with papilledema (5.82 ± 3.71 mm3 in IIH vs. 2.26 ± 0.58 mm3 in healthy controls) when Albrecht et al. [11] compared them to healthy controls. Both the ONHV and peripapillary RNFL thickness decreased significantly after treatment began (either with acetazolamide or weight loss).

Similar to the current study, Kaufhold et al. [20] employed SD-OCT; however, they focused on optic nerve head volume as a possible indicator of treatment effectiveness and disease progression in IIH. A criteria for the diagnosis and progression of IIH was the ONH volume estimated by SD-OCT. Ultimately, it was determined that measuring ONH volume provided more accurate results than intracranial pressure. Additionally, Rebolleda et al. [23] 's correlation analysis of the optic disc's morphology and changes in the perimetric threshold using OCT showed that the severity of papilledema quantitatively correlates with the visual field sensitivity. Defects in the visual field improved concurrently with the edema's clearance following treatment. This raises the possibility that OCT could be employed in IIH to track the degree of papilledema and the success of treatment.

Even Kaufhold et al. [20] employed SD-OCT later on. But those researchers looked at optic nerve head volume to see if it could indicate therapy success or disease progression in IIH. A statistically significant link was discovered in that pilot cross-sectional investigation comparing controls and patients with IIH; the volume of the ONH, as determined by SD-OCT, served as a diagnostic and prognostic indicator for IIH. The measurement of intracranial pressure was shown to be less sensitive than ONH volume in the end.

According to Huang-Link et al. [26], the increase in RNFL thickness seen in idiopathic intracranial hypertension (IIHWP) is consistent with the process that leads to the formation of papilledema. Disc edema produced by intracranial pressure is a mechanical occurrence. This happens when the optic nerve sheath is unable to compensate for abnormally high cerebrospinal fluid pressures. Primary papilledema is caused by axoplasmic leakage into the RNFL surface from the optic nerve fibers. Papilledema is partially caused by venous stasis, which allows fluid to escape into the extracellular space. Their findings lend credence to this notion, showing that in a swollen optic disc, the immediate reduction in CST pressure by CSF removal coincides with a decrease in RNFL thickness, in contrast to a normal oncotic lens. Unlike with ophthalmoscopy, optical coherence tomography (OCT) can immediately reveal such minute ONH alterations. We may analyze the most afflicted layer first since OCT accurately measures and finely visualizes the retinal layers. In our opinion, RNLF changes that occur in tandem with CSF evacuation and subsequently during acetazolamide treatment serve as a distinct biomarker for primary papilledema, as opposed to secondary extracellular stasis. Consequently, the RNLF provides a one-of-a-kind method for tracking the progression of idiopathic intracranial hypertension and assessing the efficacy of treatment.

There are some limitations to the study including a small number of patients, not evaluating the long-term changes in the refractive measures, having a heterogeneous study population and not comparing the results with different imaging modalities.

CONCLUSION

One non-invasive quantitative technique that can replace opening pressure in patient follow-up is optical coherence tomography (OCT) imaging, which is more sensitive than clinical results. PET/OCT scans are quick and cheap. The average duration of an eye exam is less than ten minutes. By utilizing OCT in the follow-up of operated IIH patients, clinicians can monitor the effectiveness of surgical interventions and make informed decisions regarding further management. Serial OCT examinations can detect subtle changes in optic nerve morphology that may not be detected by clinical examination alone. This early detection of structural abnormalities enables prompt intervention and optimization of treatment strategies, potentially preventing further vision loss.

Conflict of Interest: No potential conflict of interest to be reported by the authors

No financial disclosure

REFERENCES

1. Markey KA, Mollan SP, Jensen RH, Sinclair AJ. Understanding idiopathic intracranial hypertension: mechanisms,

management, and future directions. Lancet Neurol., 2016; 15(1):78-91.
2. Friedman DI, Liu GT, Digre KB. Revised diagnostic criteria for the pseudotumor cerebri syndrome in adults and children. Neurology, 2013; 81(13):1159-65.
3. Marzoli SB, Ciasca P, Curone M, Cammarata G, Melzi L, Criscuoli A, et al. Quantitative analysis of optic nerve damage in idiopathic intracranial hypertension (IIH) at diagnosis. Neurol Sci., 2013; 34 Suppl 1:143-5.
4. Killer HE, Jaggi GP, Miller NR. Papilledema revisited: is its pathophysiology really understood?. Clin Exp Ophthalmol., 2009; 37(5):444-7.
5. Duits FH, Martinez-Lage P, Paquet C, Engelborghs S, Lleó A, Hausner L, et al. Performance and complications of lumbar puncture in memory clinics: Results of the multicenter lumbar puncture feasibility study. Alzheimers Dement., 2016; 12(2):154-63.
6. Satti SR, Leishangthem L, Chaudry MI. Meta-Analysis of CSF Diversion Procedures and Dural Venous Sinus Stenting in the Setting of Medically Refractory Idiopathic Intracranial Hypertension. AJNR Am J Neuroradiol., 2015; 36(10):1899-904.
7. Yadav YR, Parihar V, Pande S, Namdev H, Agarwal M. Endoscopic third ventriculostomy. J Neurosci Rural Pract., 2012; 3(2):163-73.
8. Sinclair AJ, Burdon MA, Nightingale PG, Matthews TD, Jacks A, Lawden M, et al. Rating papilloedema: an evaluation of the Frisén classification in idiopathic intracranial hypertension. J Neurol., 2012; 259(7):1406-12.
9. Shiralkar S, Rennie A, Snow M, Galland RB, Lewis MH, Gower-Thomas K. Doctors' knowledge of radiation exposure: questionnaire study. BMJ., 2003; 327(7411):371-2.
10. Huang D, Swanson EA, Lin CP, Schuman JS, Stinson WG, Chang W, et al. Optical coherence tomography. Science, 1991; 254(5035):1178-81.
11. Albrecht P, Blasberg C, Ringelstein M, Müller AK, Finis D, Guthoff R, et al. Optical coherence tomography for the diagnosis and monitoring of idiopathic intracranial hypertension. J Neurol., 2017; 264(7):1370-80.
12. Toscano S, Lo Fermo S, Reggio E, Chisari CG, Patti F, Zappia M. An update on idiopathic intracranial hypertension in adults: a look at pathophysiology, diagnostic approach and management. J Neurol., 2021; 268(9): 3249-68.
13. Attia R, Fitoussi R, Mairot K, Demortiere S, Stellman JP, Tilsley P, et al. Risk factors associated with progression from papilloedema to optic atrophy: results from a cohort of 113 patients. *BMJ Open Ophthalmol*., 2023; 8(1): e001375.
14. Dreesbach M, Joachimsen L, Küchlin S, Reich M, Gross NJ, Brandt AU, et al. Optic Nerve Head Volumetry by Optical Coherence Tomography in Papilledema Related to Idiopathic Intracranial Hypertension. *Transl Vis Sci Technol*., 2020; 9(3):24.
15. Lasheen A. M. Z, Almasry M. A, Mostafa M. M. Assessment and grading of papilledema using optical Coherence Tomography. *AIMJ*, 2023; *4*(1): 12.
16. Scott CJ, Kardon RH, Lee AG, Frisén L, Wall M. Diagnosis and grading of papilledema in patients with raised intracranial pressure using optical coherence tomography vs clinical expert assessment using a clinical staging scale. *Arch Ophthalmol*., 2010; 128(6):705-11.
17. Mohamed M. T, Aldghaimy A. H, Elsoghair O. A, Aita W. E. Diagnosis and Grading of Papilledema Using Optical Coherence Tomography Compared to Clinical Staging By Frise´ n Scale. SVU-IJMS, 2020; 3(2), 14-9.
18. Khalil D. H, Labib D. M. Correlation between optical coherence tomography parameters and retinal sensitivity in idiopathic intracranial hypertension. J EGYPT OPHTHALMOL, 2015; *108*(2), 61-6.
19. Auinger P, Durbin M, Feldon S, Garvin M, Kardon R, Keltner J, et al. Baseline OCT measurements in the idiopathic intracranial hypertension treatment trial, part II: correlations and relationship to clinical features. Invest Ophthalmol Vis Sci., 2014; 55(12):8173-9.
20. Kaufhold F, Kadas EM, Schmidt C, Kunte H, Hoffmann J, Zimmermann H, et al. Optic nerve head quantification in idiopathic intracranial hypertension by spectral domain OCT. *PLoS One*., 2012; 7(5): e36965.
21. Waisbourd M, Leibovitch I, Goldenberg D, Kesler A. OCT assessment of morphological changes of the optic nerve head and macula in idiopathic intracranial hypertension. *Clin Neurol Neurosurg*., 2011; 113(10):839-43.
22. Skau M, Sander B, Milea D, Jensen R. Disease activity in idiopathic intracranial

hypertension: a 3-month follow-up study. J Neurol., 2011; 258(2):277-83.

23. Rebolleda G, Muñoz-Negrete FJ. Follow-up of mild papilledema in idiopathic intracranial hypertension with optical coherence tomography. *Invest Ophthalmol Vis Sci*., 2009; 50(11):5197-200.

24. Chen JJ, Thurtell MJ, Longmuir RA, Garvin MK, Wang JK, Wall M,et al. Causes and Prognosis of Visual Acuity Loss at the Time of Initial Presentation in Idiopathic Intracranial Hypertension. *Invest Ophthalmol Vis Sci*., 2015; 56(6):3850-9.

25. Hamed A. E. S, Monzer M. A. E, Hamed E. F. A, Elgazar A. F. Prognostic Value of Optical Coherence Tomography in Idiopathic Intracranial Hypertension. *IJMA*, 2022; *4*(10): 2756-62.

26. Huang-Link Y, Eleftheriou A, Yang G, Johansson JM, Apostolou A, Link H, et al. Optical coherence tomography represents a sensitive and reliable tool for routine monitoring of idiopathic intracranial hypertension with and without papilledema. *Eur J Neurol*., 2019; 26(5): 808-57.

Figure legend

Figure 1: Disc elevation in papilledema. A) Horizontal edge. B) Vertical edge

Figures 2: disc radial and disc map in Rt eye of moderate papilledema shows increase RNFL thickness and elevation of disc.

Citation

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