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Prevalence of Glaucoma among High Myopia

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ABSTRACT

Background: Glaucoma is an optic neuropathy that is characterized by the selective loss of retinal ganglion cells and their axons, which manifests as the loss of the retinal nerve fiber layer (RNFL). Numerous studies have shown that the extent of RNFL damage correlates with the severity of functional deficit in the visual field (VF), and that RNFL measurement by optical coherence tomography (OCT) has good sensitivity for the detection of glaucoma. **Purpose:** To assess the prevalence of glaucoma among high myopic patients and the association between them using standard automated perimetry (SAP) and optical coherence tomography (OCT).

Patients and Methods: A prospective observational randomized cross sectional study included a total of 80 eyes with high myopia, in the period from November 2017 to April 2018.

Results: This cross sectional study included 44 subjects with 80 eyes regarding high myopia using the outpatient services of the Qlawoon Hospital, Cairo, who satisfied the inclusion and exclusion criteria between November 2017 and April 2018 aiming to determine the prevalence of glaucoma in high myopic patients.

Conclusion: RNFL thickness mean is; for average thickness is 86.37, for superior thickness is 90.06 and for inferior thickness is 82.68 a highly significant P-value.

Keywords: Glaucoma - high myopia - intraocular pressure - myopic macular degenerations.

INTRODUCTION

Glaucoma is an optic neuropathy that is characterized by the selective loss of retinal ganglion cells and their axons, which manifests as the loss of the retinal nerve fiber layer (RNFL). Numerous studies have shown that the extent of RNFL damage correlates with the severity of functional deficit in the visual field (VF), and that RNFL measurement by optical coherence tomography (OCT) has good sensitivity for the detection of glaucoma [(1)].

High myopia (6 D or more) is a known risk factor for open angle glaucoma [(2)].

Previous hospital-based studies and population-based investigations have shown that myopia, in particular high axial myopia, can be a risk factor for glaucomatous optic neuropathy [(3)].

It has remained unclear, which factors associated with myopia were responsible for the increased susceptibility for glaucomatous optic nerve damage in myopic eyes. Histological studies reported on morphological particularities in eyes with axial high myopia. These features included a thinning and stretching of the lamina cribrosa in the highly myopic secondary macrodiscs (also called megalodiscs), and an elongation and thinning of the peripapillary scleral flange in the parapapillary region of highly myopic optic nerve heads [(4)].

Clinical diagnosis of glaucoma in this group of patients is often difficult because of the variation in the sizes, shapes, tilt of the optic nerve head, and the presence of large peripapillary atrophy (PPA) in these eyes. In high myopia, RNFL loss also occurs more frequently in a generalized or diffuse pattern rather than in a localized pattern. These characteristics of highly myopic eyes make it difficult to accurately determine the cup-to-disc ratio and the extent of RNFL damage in susceptible patients [(5)].An early detection and follow up of glaucoma require functional testing using standard automated perimetry (SAP) as gold standard, particularly the 24–2 Swedish Interactive Threshold Algorithm (SITA) strategy, as well as structural testing which can be based on ophthalmic findings. But, one of the most reliable methods for objective and precise structural measurements of glaucomatous damage is the optical coherence tomography (OCT) which provides both quantitative and qualitative measurements of the RNFL thickness. OCT in diagnostics of the ONH structural changes became a part of standard procedure for diagnosis and monitoring of patients with retinal pathology. OCT is also highly sensitive in differentiating glaucomatous from non-glaucomatous ONH changes [(6)].

PATIENTS AND METHODS

A prospective observational randomized cross sectional study included a total of 80 eyes with high myopia, in the period from November 2017 to April 2018. **The study was approved by the Ethics Board of Ain Shams University.**

Inclusion criteria:

1. Spherical equivalent refraction 6.0 D or more.

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2. Best corrected visual acuity 20/200 or better.
3. A healthy anterior segment appearance on examination with slit-lamp biomicroscopy; open angles at gonioscopy; and reliable visual field (VF) results.

Exclusion criteria:

1. A history of ocular surgery (except for uncomplicated cataract surgery).
2. Other diseases affecting the VFs (e.g., neuro-ophthalmological diseases, uveitis, or retinal and/or choroidal diseases, trauma).

Assessment of selected patients:

- ***All patients were subjected to:***

1. Medical history taking.
2. Visual acuity assessment using Auto Refractometer, refraction and best corrected visual acuity (B.C.V.A) assessment using Snellen chart and also calculated in Logarithm of Minimum Angle of Resolution (LogMAR).

Table (1): Conversion table for Snellen's to LogMAR equivalent ***(Rice et al.)*** [7]

Snellen	LogMAR	Snellen	LogMAR
6/6	0.00	6/48	0.90
6/7.5	0.10	6/60	1.00
6/9.5	0.20	6/90	1.2
6/12	0.30	6/120	1.3
6/15	0.40	6/150	1.4
6/19	0.50	6/180	1.5
6/24	0.60	6/240	1.6
6/30	0.70	6/360	1.8
6/38	0.80	6/480	1.9

3. Slit lamp examination of anterior chamber.
4. Fundus examination *(ONH examination)* using slit lamp biomicroscopy with +90 Diopter lens.

- **Technique of ONH examination by non contact slit lamp 90 D lens:**

- Measurement of the vertical and horizontal C/D ratios by using slit beam to measure the actual disc size then the diameters was multiplied by correction factor (1.3 for the Volk 90 D), ISNT rule was taken in account in checking for disc rim thinning a full 360 degree. (Since glaucomatous discs tend to present with thinning and/or notching of the inferior and/or superior disc rims).
- Sometimes, Green light beam on slit lamp was used to provide clearer view of optic disc border (scleral rim).
- The optic disc was viewed and its vessels stereoscopically to assess the extent of the internal rim border. Disc rim sloping or saucerization was noted, which might be an early, subtle sign of damage.
- Evaluation of optic disc color, noting if it was pink or pale. (However, focusing solely on the disc color may lead to an underestimation of the C/D ratio, since the cup region is not where the nerve tissue is situated. The tissue in the rim is what becomes thinned in eyes with glaucoma).
- Bilateral examination of the optic disc was done to determine any significant asymmetry (Asymmetry of 0.2 or more between the two ONs raises suspicion for possible glaucoma).
- Examination of the peripapillary area for atrophy (i.e., the alpha and beta zones), since this finding has been associated with glaucoma and risk for its progression.
- Looking for other signs like optic disc hemorrhage which often appear as either splinter or flame-shaped at the edges of the optic disc, their presence often indicate optic neuropathy. They are rare in normal eyes and appear in approximately 4 to 7 percent of glaucomatous eyes.

5. Intraocular pressure measurement by Goldmann applanation tonometer.
6. Standard automated perimetry (SAP)

Technique:

We used Swedish Interactive Threshold Algorithm (SITA), algorithm developed for the Humphrey perimeter uses a complex mathematical model to estimate threshold values for each point based on responses to stimuli presented at that location, as well as information gathered from nearby locations [8]. Full threshold values are still obtained for the first 4 points tested (one in each quadrant of the visual field), and at least one reversal from descending to ascending intensity is obtained for each location. Test times in normal individuals are roughly half as long as full threshold tests, with similar or better reproducibility [9].

7. Optical coherence tomography (OCT) (RTVue-100 [Optovue]).

Technique:

The 3D Disc protocol is a 6× 6 mm raster scan centered on the optic disc and comprises 101 B-scans, each of which comprises 513 A-scans. The resulting scan provides a three dimensional image of the optic disc and surrounding area.

The ONH protocol comprises 12 radial scans 3.4 mm in length (455 A-scans each) and 13 concentric ring scans ranging from 1.3 to 4.9 mm in diameter (425, 587, 775, or 965 A-scans each), all centered on the optic disc (using the previously drawn contour line to ensure scan registration). This scan configuration provides 14, 141 A-scans in 0.55 seconds. Areas between A-scans are interpolated. A polar RNFL thickness map and various parameters that describe the optic disc are provided. RNFL thickness measurements were obtained for the 3.45-mm–diameter ring. RNFL thickness parameters were measured by assessing a total of 2325 data points

between the anterior and posterior RNFL borders [10].

Statistical Analysis

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when their distribution found parametric while with non parametric data were presented as median with inter-quartile range (IQR). Also qualitative data were presented as number and percentages.

RESULTS

Eighty eyes of forty four patients with high myopia were selected for this prospective observational randomized study (Table 2).

Table (1): Clinical characteristics of distribution of the study group

		Total no. = 80 eyes
Laterality	OD OS	42 (52.5%) 38 (47.5%)
UCVA	Mean ± SD Range	1.07 ± 0.29 0.48 – 1.78
BCVA	Mean ± SD Range	0.56 ± 0.28 0.18 – 1
Spherical equivalent (Diopters)	Median (IQR) Range	-9.75 (-13.5 – -7.25) -22 – -6
Intraocular pressure	Mean ± SD Range	17.85 ± 2.86 12 – 26
Vertical Cup/Disc ratio	Mean ± SD Range	0.51 ± 0.12 0.3 – 0.7
Mean deviation (dB)	Median (IQR) Range	-1.93 (-5.23 – -0.73) -13.46 – 1.76
Pattern standard deviation (dB)	Mean ± SD Range	2.38 ± 1.34 1.13 – 6.38
Glaucoma hemifield test	Border line General reduction of sensitivity Outside normal limits Within normal limits	8 (10.0%) 12 (15.0%) 22 (27.5%) 38 (47.5%)
Avg.RNFL thickness	Mean ± SD Range	96.45 ± 15.01 59.21 – 145.12
Sup. Avg	Mean ± SD Range	100.06 ± 18.13 58.61 – 157.62
Inf. Avg.	Mean ± SD Range	94.87 ± 15.40 59.81 – 132.64

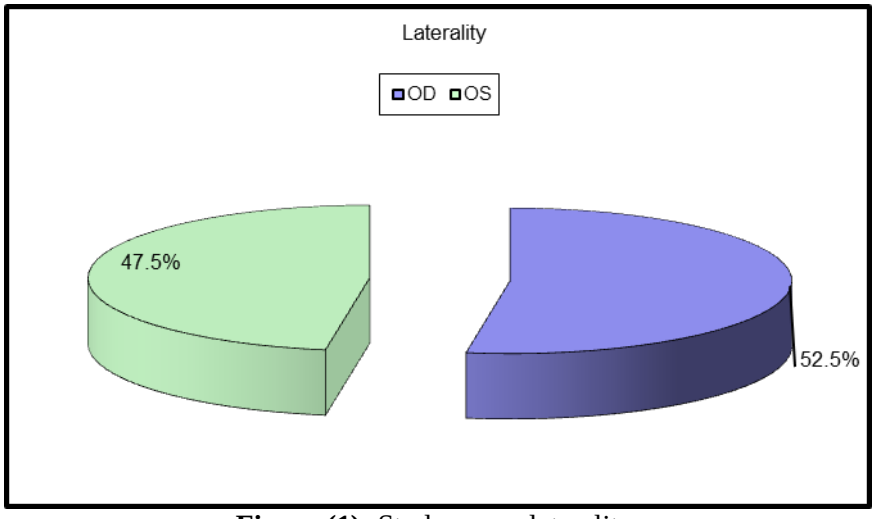

Figure (1): Study group laterality.

This figure shows that among our cases there were 47.5% with high myopia in left (OS) eye and 52.5% with high myopia in right eye.

Table (2): Percentage of glaucoma among study group

G or NG	No.	%
NG	46	57.5%
G	34	42.5%
Total	80	100.0%

This table shows that 34 eyes are affected with glaucoma out of the 80 examined eyes with a percentage of 42.5%.

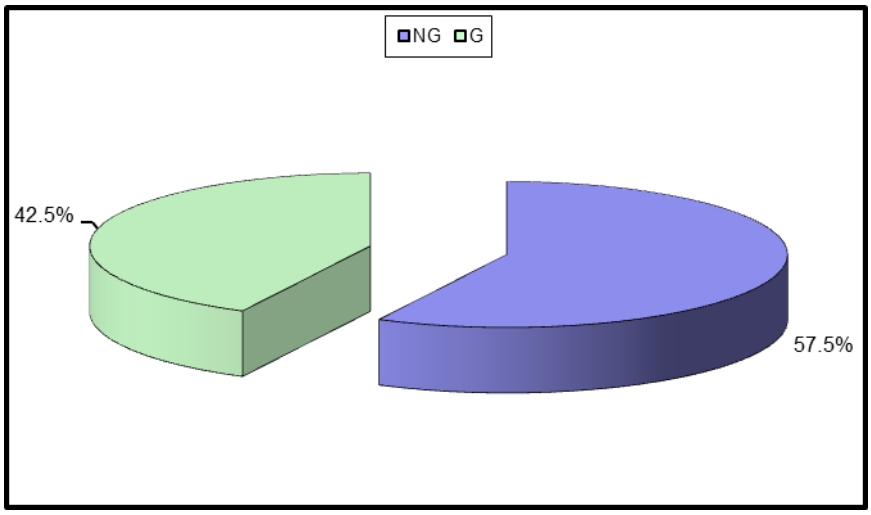

Figure (2): Percentage of glaucoma among study group.

This figure shows that the percentage of glaucoma among our study group is 42.5%.

Table (3): Predictors of glaucoma in our study group

		NG	G	Test value	P-value	Sig.
		No. = 46	No. = 34			
Laterality (right: left)	OD OS	24 (52.2%) 22 (47.8%)	18 (52.9%) 16 (47.1%)	0.005*	0.946	NS
UCVA	Mean ± SD Range	0.96 ± 0.26 0.48 – 1.3	1.22 ± 0.27 0.78 – 1.78	4.376•	0.000	HS
BCVA	Mean ± SD Range	0.43 ± 0.25 0.18 – 1	0.74 ± 0.23 0.3 – 1	5.624•	0.000	HS
Spherical equivalent (Diopters)	Median (IQR) Range	-9 (-11.5 – -6.5) -18 – -6	-12 (-16 – -9) -22 – -6.5	-2.828ǂ	0.005	HS
Intraocular pressure	Mean ± SD Range	17.30 ± 2.36 14 – 24	18.59 ± 3.32 12 – 26	2.023•	0.046	S
Vertical Cup/Disc ratio	Mean ± SD Range	0.48 ± 0.11 0.3 – 0.7	0.55 ± 0.12 0.4 – 0.7	2.759•	0.007	HS
Mean deviation (dB)	Median (IQR) Range	-0.99 (-2.05 – 0.26) -6.41 – 1.76	-5.38 (-8.38 – -2.19) -13.46 – -0.49	-5.686ǂ	0.000	HS
Pattern standard deviation (dB)	Mean ± SD Range	1.53 ± 0.25 1.13 – 2.02	3.53 ± 1.36 1.17 – 6.38	9.774•	0.000	HS

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

*: Chi-square test; •: Independent t-test; ǂ: Mann-Whitney test.

This table presents the predictors of glaucoma: UCVA, BCVA, spherical equivalent, vertical cup/disc ratio, mean deviation, pattern standard deviation all are highly significant with a P-value < 0.01, intraocular pressure is significant with a P-value < 0.05. But laterality is non-significant with a P-value > 0.05.

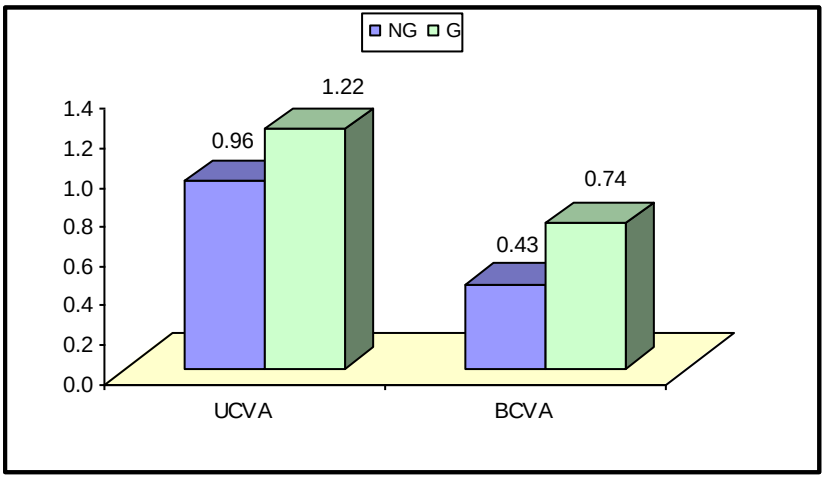

Figure (3): Relation between UCVA, BCVA and glaucoma.
This bar chart shows that glaucoma presents when the mean UCVA is 1.22 and the mean BCVA is 0.74.

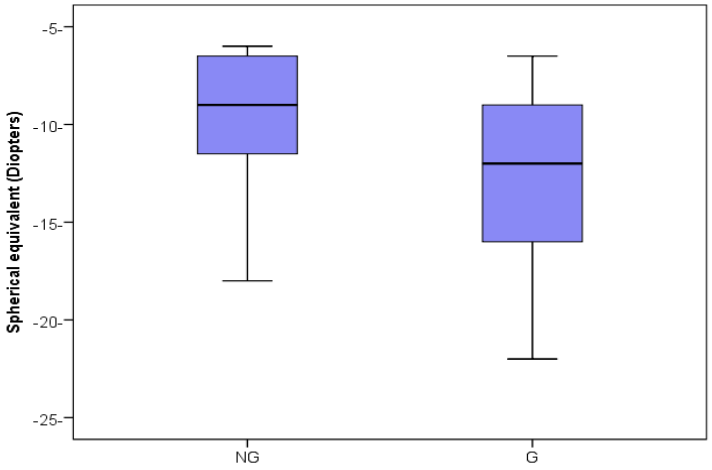

Figure (4): Relation between spherical equivalent and glaucoma.
This chart shows that glaucoma presents when spherical equivalent median is -12 (-16 – -9)
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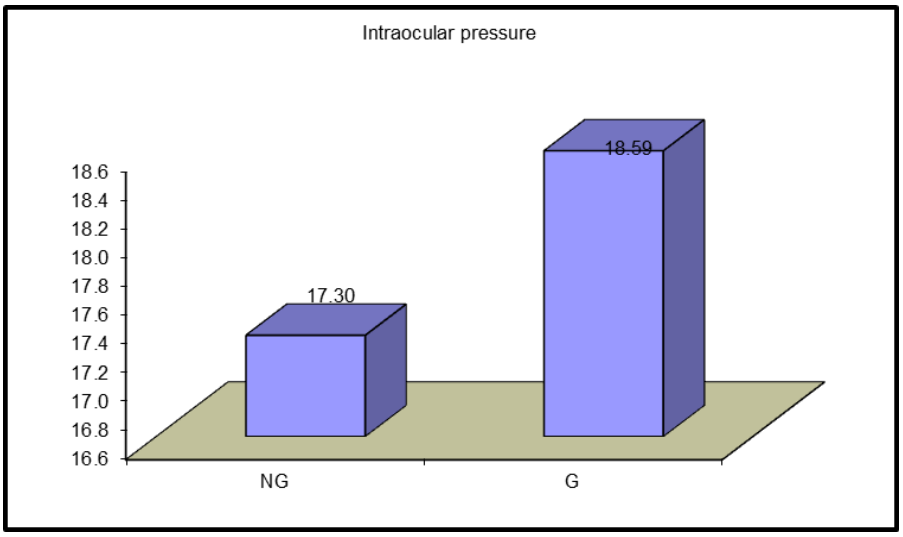

Figure (5): Relation between intraocular pressure and glaucoma.
This bar chart shows that glaucoma presents when intraocular pressure mean is 18.59 or more.

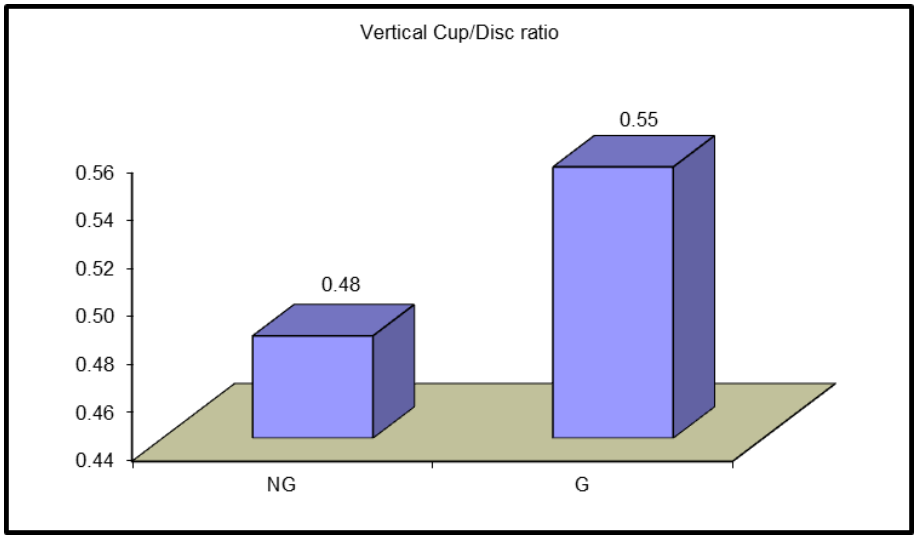

Figure (6): Relation between glaucoma and vertical cup/disc ratio.
This bar chart shows that glaucoma presents when the mean vertical cup/disc ratio is 0.55 or more.

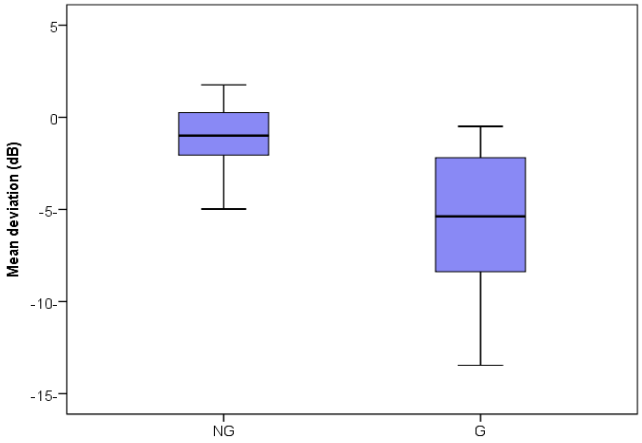

Figure (7): Relation between glaucoma and mean deviation in visual field assessment.
This bar chart shows glaucoma presents when the mean deviation median is -5.38(-8.38 – -2.19).

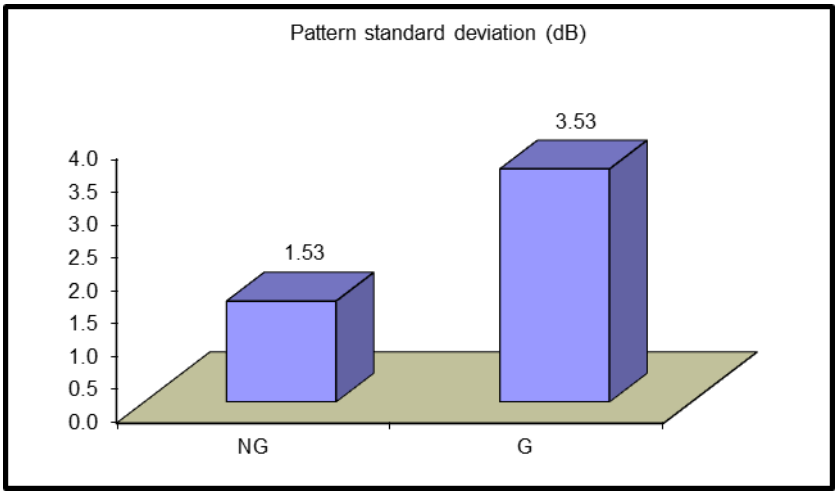

Figure (8): Relation between glaucoma and pattern standard deviation in visual field assessment.
This bar chart shows that glaucoma presents when the pattern standard deviation mean is 3.53.

Table (4): Relation between glaucoma and glaucoma hemifield test in visual field assessment

Glaucoma hemifield test	NG		G		Test value*	P-value	Sig.
	No.	%	No.	%			
Border line	2	4.3%	6	17.6%	61.586	0.000	HS
General reduction of sensitivity	6	13.0%	6	17.6%			
Outside normal limits	0	0.0%	22	64.7%			
Within normal limits	38	82.6%	0	0.0%			

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant,*: Chi-square test.

This table shows that glaucoma hemifield test is a highly significant predictor of glaucoma with a P-value < 0.01. With a percentage of 64.7% (22 eyes) outside normal limits, 17.6% (6 eyes) borderline and 17.6% (6 eyes) general reduction of sensitivity.

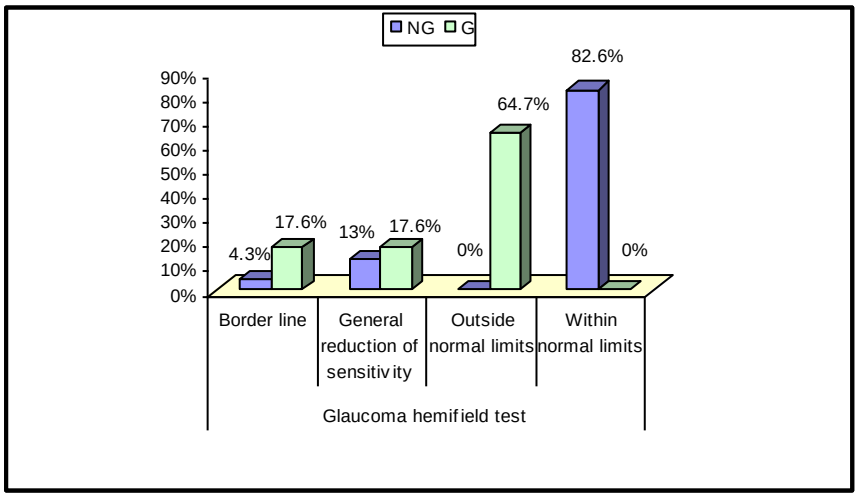

Figure (9): Relation between glaucoma and glaucoma hemifield test in visual field assessment.

This figure shows the percentage of glaucoma in different glaucoma hemifield test results (64.7% outside normal limits, 17.6% borderline and 17.6% general reduction of sensitivity).

Table (5): Relation between glaucoma and RNFL- OCT parameters

		NG	G	Test value•	P-value	Sig.
		No. = 46	No. = 34			
Avg.RNFL thickness	Mean ± SD Range	103.90 ± 12.74 85.81 – 145.12	86.37 ± 11.66 59.21 – 103.45	-6.308	0.000	HS
Sup. Avg	Mean ± SD Range	107.46 ± 16.47 76.8 – 157.62	90.06 ± 15.40 58.61 – 116.58	-4.801	0.000	HS
Inf. Avg.	Mean ± SD Range	103.87 ± 11.28 79.45 – 132.64	82.68 ± 11.32 59.81 – 101.66	-8.294	0.000	HS

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
•: Independent t-test.

This table shows the effect of glaucoma on RNFL thickness in our study group with a highly significant P- value <0.01with average thickness mean (Avg.RNFL) 86.37, average superior thickness mean (Sup. Avg) 90.06 and average inferior thickness mean (Inf. Avg.) 82.68.

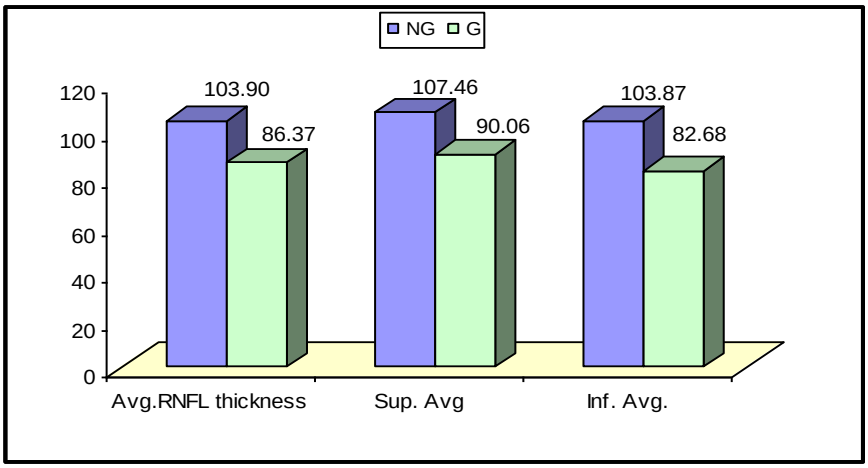

Figure (10): Relation between glaucoma and RNFL-OCT parameters.

This figure shows the mean of RNFL thickness in our study group which was diagnosed as being glaucomatous with average thickness mean (Avg.RNFL) 86.37, average superior thickness mean (Sup. Avg) 90.06 and average inferior thickness mean (Inf. Avg.) 82.68.

Table (6): Logistic regression analysis for predictors of glaucomatous (G) group

	B	S.E.	Wald	P-value	dds ratio (OR)	95% C.I. OR	
						Lower	Upper
'A	3.718	1.021	13.256	0.000	41.191	5.566	304.836
'A	4.789	1.126	18.079	0.000	120.22	13.219	1093.364
rical equivalent ters	-0.161	0.059	7.52	0.006	0.851	0.759	0.955
ocular pressure	0.166	0.086	3.738	0.053	1.18	0.998	1.396
ical Cup Disc ratio	5.458	2.112	6.677	0.010	24.588	3.737	147.76
n deviation dB	-0.538	0.124	18.786	0.000	0.584	0.458	0.745
rn standard ation dB	4.344	1.116	15.158	0.000	76.987	8.645	685.572
RNFL thickness	-0.164	0.039	18.075	0.000	0.848	0.787	0.915
Avg	-0.077	0.02	14.71	0.000	0.926	0.89	0.963
Avg	-0.207	0.047	19.435	0.000	0.813	0.741	0.891

This table shows more accurate analysis of our data which called logistic regression analysis presents the P-value and odds ratio of each discussed predictor:

- Patients with high UCVA (according to LogMAR equivalent) are exposed to glaucoma 41.191 times than others with a highly significant P –value.
- Patients with high BCVA (according to LogMAR equivalent) are exposed to glaucoma 120.22 times than others with a highly significant P –value.
- Patients with low spherical equivalent are exposed to glaucoma 0.851 times than others with a highly significant P –value.
- Patients with low intraocular pressure are exposed to glaucoma 1.18 times than others with a non -significant P –value.
- Patients with high vertical cup/ disc ratio are exposed to glaucoma 24.588 times than others with a highly significant P –value.
- Patients with low mean deviation are exposed to glaucoma 0.584 times than others with a highly significant P –value.
- Patients with high pattern standard deviation are exposed to glaucoma 76.987 times than others with a highly significant P –value.
- Patients with low average RNFL thickness are exposed to glaucoma 0.848 times than others with a highly significant P –value.
- Patients with low sup. RNFL thickness are exposed to glaucoma 0.926 times than others with a highly significant P –value.
- Patients with low inf. RNFL thickness are exposed to glaucoma 0.813 times than others with a highly significant P –value.

Table (7): Receiver operating characteristic curve (ROC) of our study group

Variables	Cut off point	AUC	Sensitivity	Specificity	+PV	-PV
UCVA	>1	0.747	58.82	73.91	62.5	70.8
BCVA	>0.78	0.817	64.71	84.78	75.9	76.5
Spherical equivalent (Diopters)	≤ -12	0.685	52.94	78.26	64.3	69.2
Intraocular pressure	>18	0.647	47.06	86.96	72.7	69.0
Vertical Cup/Disc ratio	>0.5	0.655	52.94	78.26	64.3	69.2
Mean deviation (dB)	≤ -1.36	0.873	94.12	65.22	66.7	93.7
Pattern standard deviation (dB)	>2.02	0.931	88.24	100.00	100.0	92.0
Avg.RNFL thickness	≤ 90	0.855	70.59	91.30	85.7	80.8
Sup. Avg	≤ 96.8	0.775	70.59	78.26	70.6	78.3
Inf. Avg.	≤ 88.68	0.913	76.47	95.65	92.9	84.6

This table shows further analysis of our data by ROC curve presenting the cut- off point of each predictor, AUCs, its sensitivity and specificity in a chronological order according to AUCs:

- Patients with high pattern standard deviation (cut-off point >2.02) are exposed to glaucoma with AUCs 93.1, sensitivity 88.24 and specificity 100.00.
- Patients with low inf. RNFL thickness (cut-off point ≤ 88.68) are exposed to glaucoma with AUCs 91.3, sensitivity 76.47 and specificity 95.65.
- Patients with low mean deviation (cut-off point ≤ -1.36) are exposed to glaucoma with AUCs 87.3, sensitivity 94.12 and specificity 65.22.
- Patients with low average RNFL thickness (cut-off point ≤ 90) are exposed to glaucoma with AUCs 85.5, sensitivity 70.59 and specificity 91.30.
- Patients with high BCVA (cut-off point >0.78) are exposed to glaucoma with AUCs 81.7, sensitivity 64.71 and specificity 84.78.
- Patients with low sup. RNFL thickness (cut-off point ≤ 96.8) are exposed to glaucoma with AUCs 77.5, sensitivity 70.59 and specificity 78.26.
- Patients with high UCVA (cut-off point >1) are exposed to glaucoma with AUCs 74.7, sensitivity 58.82 and specificity 73.91.
- Patients with high vertical cup/ disc ratio (cut-off point >0.5) are exposed to glaucoma with AUCs 65.5, sensitivity 52.94 and specificity 78.26.
- Patients with low spherical equivalent (cut-off point ≤ -12) are exposed to glaucoma with AUCs 68.5, sensitivity 52.94 and specificity 78.26.
- Patients with low intraocular pressure (cut-off point >18) are exposed to glaucoma with AUCs 64.7, sensitivity 47.06 and specificity 86.96.

DISCUSSION

Diagnosing glaucoma in myopic eyes can be challenging, mainly because of the morphologic changes in the optic disc, such as PPA related to myopia, and atypical VF defects such as an enlarged blind spot, temporal peripheral defect, or generalized reduction in sensitivity.

Thus, true glaucomatous eyes can sometimes be misdiagnosed with conventional diagnostic tools such as fundus examinations or VF testing. With improvements in technology, ophthalmic imaging, such as OCT, has been found to be important adjunct to clinical diagnosis of glaucoma [(6)].

This cross sectional study included 44 subjects with 80 eyes regarding high myopia using the outpatient services of the Qlawoon Hospital, Cairo, who satisfied the inclusion and exclusion criteria between November 2017 and April 2018 aiming to determine the prevalence of glaucoma in high myopic patients.

According to our study;

Regarding high myopia degree, glaucoma presents when spherical equivalent median is -12 (-16 – -9) with a highly significant p- value (0.005).

Intraocular pressure mean is 18.59 in glaucoma cases but with non-significant P-value (0.053).

Vertical cup/disc ratio mean is 0.55 with ahighly significant P-value (0.01) in glaucomatous patients.

According to visual field parameters, all are highly significant mean deviation median is -5.38 with highly significant P-value, pattern standard deviation mean is 3.53 with highly significant P-value.

According to thickness parameters of RNFL-OCT, all are highly significant P-value with AUCs 85.5 for average RNFL thickness.

So our study results support the findings from previous large population-based studies on myopia and glaucoma;

Shoji et al.* [10] *showed that AUCs for the RNFL average was 82.6 and was statistically significant (*P* -0.017).

The BMES in Australia found an association between all categories of myopia and glaucoma diagnosed by the presence of matching optic disc cupping with rim thinning (cup-to-disc ratio 0.7, or cup to- disc asymmetry 0.3) and characteristic visual field loss on automated perimetry [11].

The BES in China found an association between severe myopia greater than - 6 D and glaucomatous optic nerve appearance, visual field defects, and elevated IOP [12].

The Los Angeles Latino Eye Study of a Latino population in the US found an association between axial myopia and open angle glaucoma defined by the presence of an open angle and a glaucomatous visual field abnormality and/or evidence of glaucomatous optic nerve damage in at least one eye, particularly in individuals with elevated IOP [13], but our study found that patients with low intraocular pressure are exposed to glaucoma 1.18 times than others with a non - significant P –value.

In comparison with our study:

***Qiu et al.* [14]** studied representative sample of the entire US population, found an association between myopia and visual field defects, but not between myopia and self-reported glaucoma or vertical cup to disc ratio greater than or equal to 0.7 with the latter being a possible surrogate for glaucomatous disease; their database did not have information about subject's IOP (this is like our study according to IOP).

According to self-reported Glaucoma; the adjusted odds of self reported glaucoma were not significantly increased in severe myopia (OR 0.26, 95% CI 0.08–0.80), according to cup-to-disc ratio; the adjusted odds of vertical cup-to disc ratio greater than or equal to 0.7 were not significantly increased in severe myopia (OR 0.85, 95% CI 0.09–8.42) and according to visual field defect; the adjusted odds of having any visual field abnormality were significantly increased in subjects with severe myopia (OR 14.43, 95% CI 5.13–40.61).

Factors that may have influenced our results and conclusions:

The relationship between p-RNFL measurements and degree of myopia is controversial**.** We believe that the current normative database may not be reliable in the analysis of myopic eyes. We evaluated only highly myopic eyes, which may restrict the results. However, our results demonstrate that a specific database for highly myopic eyes could assist in differentiating highly myopic eyes with glaucoma from those without. Second, a cross-sectional study cannot show long term changes. Glaucoma is a progressive disease, and further studies with longitudinal follow-up would be useful to fully address this limitation [15].

CONCLUSION

On examination, we concluded that the glaucomatous group has the following for each predictor:

- UCVA mean is 1.22 with a highly significant P-value
- BCVA mean is 0.74 a highly significant P-value
- Spherical equivalent median is -12 a highly significant P-value
- IOP mean is 18.59 a non- significant P-value
- Vertical cup/disc ratio mean is 0.55 a highly significant P-value
- MD median of visual field is – 5.38 a highly significant P-value
- PSD mean of visual field is 3.53 a highly significant P-value
- GHT is 64.7% outside normal limits, 17.6% border line and 17.6% general reduction of sensitivity a highly significant P-value
- RNFL thickness mean is; for average thickness is 86.37, for superior thickness is 90.06 and for inferior thickness is 82.68 a highly significant P-value.

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